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# Emerging role of *Lophomonas blattarum* in respiratory disorders; patterns and immunoallergic profile

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## Abstract

**Introduction:** *Lophomonas blattarum* is an emerging protozoan parasite increasingly identified in patients with unexplained respiratory symptoms. Understanding its prevalence and association with immunological markers such as IgE and eosinophils is crucial for improving diagnostic accuracy in respiratory infections.
**Objectives:** This study aimed to investigate the patterns of *L. blattarum* in bronchoalveolar lavage (BAL) samples and to assess serum immunoglobulin E (IgE) levels and peripheral eosinophil counts in patients undergoing bronchoscopy.
**Patients and Methods:** This retrospective cross-sectional study examined the clinical and laboratory findings of 140 patients with *L. blattarum* infection identified in BAL samples who were referred for bronchoscopy at Firouzgar hospital, Tehran, Iran. Bronchoscopies and BAL sampling were performed following standard protocols, and samples were analyzed using direct smear and Giemsa staining. Relevant demographic, clinical, radiological, and laboratory data were collected and analyzed.
**Results:** The mean age of patients was 60.37±17.86 years, with a majority being female (n=86). Additionally, 82.1% of patients were hospitalized (n=115), indicating notable exposure to environmental risk factors such as cockroaches and damp living conditions. Pneumonia (43.6%) was the most frequent primary diagnosis. Laboratory findings revealed elevated C-reactive protein (CRP) and immunoglobulin E (IgE) levels (174.97±188.63 IU/mL), suggesting an inflammatory or allergic profile in many patients. Radiologically, ground-glass opacity and consolidation were the most common findings.
**Conclusion:** The results indicated that *L. blattarum* infection is frequently associated with elevated IgE and eosinophil levels. Increased awareness of its clinical and radiological patterns may enhance early diagnosis and targeted management for affected patients.

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## Introduction

*Lophomonas blattarum* is an emerging protozoan parasite increasingly recognized as a potential cause of lower respiratory tract infections, particularly in immunocompromised individuals and patients with underlying pulmonary diseases (1,2). Those with respiratory complications and other comorbidities are generally more susceptible to co-infection and tend to experience worse outcomes compared to those without, rendering them particularly vulnerable to *L. blattarum* (3,4). The clinical significance of *L. blattarum* infection remains a subject of ongoing debate due to diagnostic challenges and controversies surrounding its identification under light microscopy, where it is often misidentified as ciliated bronchial epithelial cells or other artifacts (5).

Nonetheless, accumulating case reports and small case series have highlighted its potential to cause persistent respiratory symptoms, such as chronic cough, dyspnea, low-grade fever, and wheezing, which frequently do not respond to conventional antibacterial therapies (6). Bronchoalveolar lavage (BAL) has emerged as a pivotal diagnostic tool for detecting *L. blattarum* infection, particularly in patients with unexplained or refractory respiratory symptoms (7,8). Cytological examination of BAL specimens can reveal motile, flagellated protozoa; however, differentiating them from other morphologically similar structures remains technically challenging and requires skilled microscopists (1,9).

Despite increasing recognition, the epidemiology and true burden of *L. blattarum* infection remain inadequately defined.

**Key point**

*Lophomonas blattarum* is rarely detected and likely acts as an opportunistic colonizer rather than a primary respiratory pathogen. Accurate diagnosis requires advanced techniques, as clinical symptoms more closely resemble those of bacterial infections and chronic lung diseases.

Reported cases have predominantly originated from Asian countries, suggesting possible regional prevalence or under-diagnosis in other areas due to limited awareness and diagnostic capabilities. Furthermore, the clinical spectrum of infection, host susceptibility factors, and associated laboratory findings are not fully elucidated (4). Given these gaps in current understanding, there is a clear need to more precisely delineate the clinical manifestations and laboratory patterns associated with *L. blattarum* infection to facilitate timely diagnosis and effective management. This study aims to address that need by detailing the demographic characteristics, presenting symptoms, radiological findings, hematological and immunological profiles, and treatment context of patients with confirmed *L. blattarum* infection.

## Objectives

This study aimed to investigate the pattern of *L. blattarum* in BAL samples and assess its correlation with serum immunoglobulin E (IgE) levels and peripheral eosinophil counts in patients undergoing bronchoscopy.

## Patients and Methods

### *Study design and sample size*

This retrospective cross-sectional study was conducted on individuals who underwent bronchoscopy at the Bronchoscopy Unit of Firouzgar hospital, Tehran, Iran. A non-random consecutive sampling method was employed, and the minimum required sample size was calculated using a type I error of 0.05 and a type II error of 0.20, yielding a minimum sample size of 130 patients. Considering potential dropouts, a total of 140 patients were included. All patients gave their informed consent to participate in the study.

### *Inclusion and exclusion criteria*

Inclusion criteria consisted of patients who underwent bronchoscopy at the hospital, provided that complete demographic, clinical, radiological, and laboratory data were available. Exclusion criteria encompassed patients with incomplete, missing, or illegible medical records.

### *Data collection*

Data on demographic and clinical variables including age, gender, body mass index (BMI), place of residence, potential exposure to cockroaches or termites within the preceding three and six months, comorbidities, primary diagnosis, and radiological findings were systematically recorded. All bronchoscopy procedures were conducted under sterile conditions utilizing a flexible fiberoptic bronchoscope, in accordance with the hospital's established clinical guidelines for diagnostic bronchoscopy. Patients underwent appropriate pre-procedural assessments, including laboratory tests and imaging as dictated by standard protocols. During the procedure, BAL was conducted by instilling sterile normal saline solution into the targeted bronchopulmonary segment and gently aspirating the fluid into sterile collection traps. The recovered BAL fluid samples were promptly transported to the hospital's microbiology and parasitology laboratory under controlled temperature conditions.

### *Laboratory data*

For parasitological examination, direct smears of the BAL samples were prepared on clean glass slides and properly fixed. The slides were subsequently stained using Giemsa stain to enhance the visualization of protozoan structures. Microscopic examination was performed under high-power magnification to identify *L. blattarum* trophozoites based on their morphological features. Concurrently, relevant clinical and laboratory parameters—including complete blood count (CBC) with differential (white blood cells; WBC), eosinophils, neutrophils, and lymphocytes), serum IgE levels, and C-reactive protein (CRP) values—were obtained from the patients' routine pre-bronchoscopy laboratory records to provide additional diagnostic context and support data analysis.

The normal reference ranges for these laboratory parameters are as follows; WBC ranges from 4,000 to 11,000 cells/μL; hemoglobin (Hb) levels are 12.0 to 15.5 g/dL for women and 13.5 to 17.5 g/dL for men; platelet counts typically range from 150,000 to 450,000/μL (150-450 × 1000/μL); neutrophils comprise 50 to 70% of WBC; eosinophils account for 1 to 4% of WBCs; lymphocytes represent 20 to 40% of WBC; CRP levels are <6.0 mg/L in healthy individuals, with levels exceeding 10 mg/L indicating significant inflammation; and IgE levels vary widely but are generally <100 to 150 IU/mL in adults.

### *Statistical analysis*

Descriptive statistics are presented as means ± standard deviations (SD) for continuous variables and as frequencies with percentages for categorical variables. All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

## Results

The mean age of patients was approximately 60 years, with a range encompassing young adults to the elderly, and the largest proportion belonging to older age groups. A majority of the patients were female, and most required hospitalization.

A significant number of patients reported exposure to environmental risk factors, such as cockroaches,

termites, or mites, with some living in damp conditions. Common comorbidities included hypertension, cancer, and cerebrovascular accidents. Tobacco use was relatively prevalent, while drug abuse was less common and primarily involved opium. Clinically, cough and dyspnea were the predominant symptoms. Laboratory findings frequently indicated bacterial and fungal infections, while tuberculosis was infrequently observed (Table 1).

The distribution of primary diagnoses indicated that pneumonia was the most prevalent condition, occurring significantly more frequently than any other diagnosis. Acute exacerbation of chronic obstructive pulmonary disease (COPD) and metastatic lung cancer ranked as the next most common diagnoses, although their prevalence was considerably lower. Urinary tract infections (UTIs) and angioedema were infrequent, identified in only a limited number of patients (Figure 1).

Radiological findings revealed that the predominant imaging pattern was ground-glass opacity, followed by consolidation. Less common radiological findings included lung collapse and nodules (Figure 2). The laboratory data indicated several abnormal results within the study population, including a slightly elevated mean white blood cell count and an increased mean neutrophil percentage. The mean hemoglobin level was relatively low, with some patients presenting values as low as 8 g/dL. Furthermore, the mean CRP level was significantly elevated at 37.8 mg/L, and immunoglobulin E levels demonstrated considerable variability (Table 2).

## Discussion

This study offers new insights into the clinical and laboratory characteristics of patients with suspected *L. blattarum* infection and highlights several important findings that warrant further consideration. The observed age distribution predominantly involves middle-aged and elderly patients with *L. blattarum*, nearly 70% aged between 40 and 80 years. This underscores the clinical relevance of this age group for respiratory diseases, which are known to have higher prevalence and severity with advancing age. This pattern may reflect increased biological susceptibility in older individuals or differences in healthcare-seeking behaviors across age groups, emphasizing the need for tailored diagnostic and therapeutic strategies for middle-aged and elderly populations. Additionally, the current study found that females accounted for approximately 1.6 times more cases than males. This gender imbalance could indicate genuine differences in disease prevalence, underscoring the higher incidence of this infection in females (10).

The majority of patients in our observation were hospitalized, indicating a potential correlation with greater disease severity or increased clinical concern among those admitted. Notably, more than half of the patients reported domestic exposure to cockroaches, termites, or mites, suggesting that environmental factors may contribute

**Table 1**. Demographic, clinical, and medical characteristics of patients with *Lophomonas blattarum* infection (n=140)

| Variable | | Frequency (%) |
|---|---|---|
| Patient status | Hospitalized patient | 115 (82.1) |
| | Outpatient | 25 (17.9) |
| Occupation | Unemployed | 42 (30.0) |
| | Livestock farmer | 8 (5.7) |
| | Auto parts seller | 3 (2.1) |
| | Facilities technician | 3 (2.1) |
| | Housewife | 36 (25.7) |
| | Cabinetmaker | 6 (4.3) |
| | Self-employed | 30 (21.4) |
| | Employee | 10 (7.1) |
| | Teacher | 2 (1.4) |
| Moisture in the residence | Negative | 111 (79.3) |
| | Positive | 29 (20.7) |
| Presence of cockroach, termite, and mite | Negative | 58 (41.4) |
| | Positive | 82 (58.6) |
| Comorbidities | None | 35 (25.0) |
| | Cancer | 22 (15.7) |
| | Dementia | 2 (1.4) |
| | SLE | 3 (2.1) |
| | TB | 3 (2.1) |
| | COPD | 14 (10.0) |
| | Hypertension | 33 (23.6) |
| | CVA | 20 (14.3) |
| | Diabetes mellitus | 8 (5.7) |
| Smoking | Negative | 83 (59.3) |
| | Positive | 57 (40.7) |
| Drug abuse | Negative | 128 (91.4) |
| | Positive | 12 (8.6) |
| Type of drug abused | None | 128 (91.4) |
| | Opium | 9 (6.4) |
| | Heroin | 3 (2.1) |
| | Morphine | 0 (0.0) |
| | Methadone | 0 (0.0) |
| Sinusitis | Negative | 134 (95.7) |
| | Positive | 6 (4.3) |
| Diabetes | Negative | 125 (89.3) |
| | Positive | 15 (10.7) |
| Asthma | Negative | 130 (92.9) |
| | Positive | 10 (7.1) |
| HIV | Negative | 140 (100.0) |
| | Positive | 0 (0.0) |
| Malignancy | Negative | 113 (80.7) |
| | Positive | 27 (19.3) |
| Organ transplant | Negative | 140 (100.0) |
| | Positive | 0 (0.0) |
| Corticosteroid use | Negative | 131 (93.6) |
| | Positive | 9 (6.4) |
| Antibiotic use | Negative | 18 (12.9) |
| | Positive | 122 (87.1) |
| Cough | Negative | 40 (28.6) |
| | Positive | 100 (71.4) |
| Fever | Negative | 95 (67.9) |
| | Positive | 45 (32.1) |
| Dyspnea | Negative | 37 (26.4) |
| | Positive | 103 (73.6) |
| TB (other tests) | Negative | 132 (94.3) |
| | Positive | 8 (5.7) |
| Bacterial infection | Negative | 102 (72.9) |
| | Positive | 38 (27.1) |
| Fungal infection | Negative | 96 (68.6) |
| | Positive | 44 (31.4) |
| Direct smear (40x objective) | Mild (1–2) | 2 (1.4) |
| | Moderate (3–5) | 4 (2.9) |
| | Severe (>5) | 0 (0.0) |
| | Not seen | 134 (95.7) |

SLE: Systemic lupus erythematosus; TB: Tuberculosis; COPD: Chronic obstructive pulmonary disease; CVA: Cerebrovascular accident; HIV: Human immunodeficiency virus.

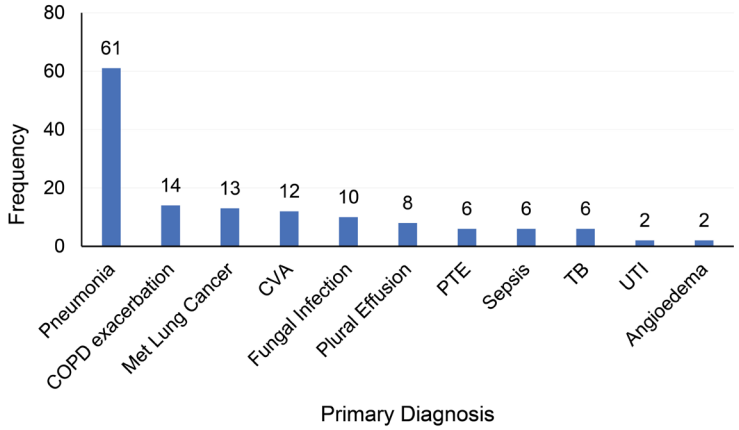


**Figure 1.** The distribution of primary diagnoses among the patients with *Lophomonas blattarum* infection. COPD: Chronic obstructive pulmonary disease; CVA: Cerebrovascular accident; PTE: Pulmonary thromboembolism; TB: tuberculosis; UTI: urinary tract infection

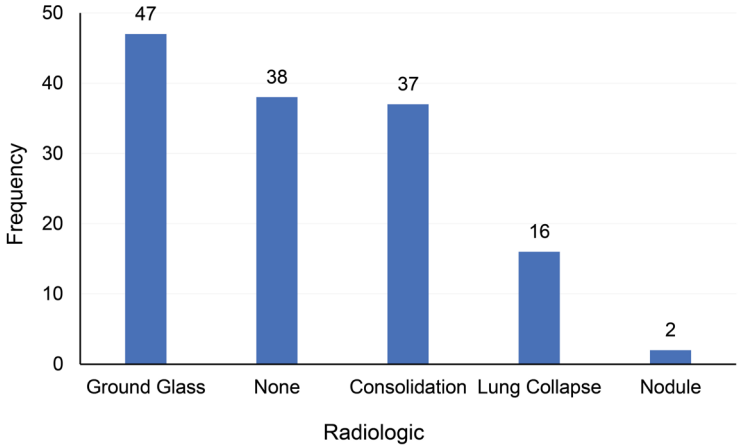


**Figure 2.** Radiographic findings of the patients with *Lophomonas blattarum* infection.

to respiratory diseases. This finding is consistent with a study by Khalil et al (11), which demonstrated that household exposure to environmental contaminants such as cockroaches and mites can significantly elevate the risk of respiratory conditions. Furthermore, previous studies have highlighted the impact of low socioeconomic status on disease prevalence, indicating that unemployment and poor economic conditions may restrict access to healthcare and heighten exposure to risk factors (12,13).

The present study revealed that a significant proportion of patients (40.7%) had a history of tobacco use. This finding aligns with previous reports highlighting the strong association between smoking and the increased incidence and severity of chronic respiratory diseases, including COPD and pneumonia (14,15). Our observations indicated that respiratory complaints, specifically dyspnea

**Table 2**. Distribution of laboratory findings and peripheral blood smear differentiation of patients with *Lophomonas blattarum* infection (n = 140)

| Parameter | Mean ± SD | Min–Max |
|---|---|---|
| WBC (cells/µL) | 10.58 ± 4.86 | 4.00 – 25.50 |
| Hemoglobin (g/dL) | 12.31 ± 2.84 | 8.00 – 20.30 |
| Platelets (×1000/µL) | 256.21 ± 169.21 | 53.00 – 742.00 |
| Neutrophils (%) | 76.46 ± 12.00 | 47.40 – 97.50 |
| Eosinophils (%) | 0.91 ± 1.58 | 0.00 – 7.00 |
| Lymphocytes (%) | 16.56 ± 9.828 | 1.80 – 44.40 |
| CRP (mg/L) | 37.84 ± 46.88 | 1.00 – 190.00 |
| IgE (IU/mL) | 174.97 ± 188.63 | 1.00 – 500.00 |

WBC: White blood cells; CRP: C-reactive protein; IgE: Immunoglobulin E; SD: Standard deviation.

and cough were prevalent in more than two-thirds of patients, while fever was reported in less than one-third. This symptomatology corresponds with the study conducted by Agusti et al, which identified dyspnea and chronic cough as hallmark symptoms of COPD, noting that fever is relatively uncommon except during acute infectious exacerbations (16).

Our laboratory findings demonstrated a predominantly bacterial inflammatory response, characterized by marked neutrophilia, elevated CRP levels, and leukocytosis. These results support the findings of Feldman and Anderson, who reported that bacterial pneumonia and acute COPD exacerbations are typically marked by a robust neutrophilic response and elevated acute-phase reactants (17). In contrast, eosinophil counts in our study were notably suppressed, despite documented exposure to mites in over half of the patients—an observation that appears paradoxical, given that environmental allergens such as mites are recognized triggers of eosinophilic airway inflammation (18). One potential explanation may involve the predominance of bacterial infection, which drives a neutrophilic response and downregulates eosinophilic pathways through inflammatory cytokines such as interleukin-6 (IL-6), as noted by Barnes (19). Furthermore, the possibility of diagnostic underestimation due to the limitations of routine peripheral blood counts should not be overlooked (20).

Interestingly, we observed elevated serum IgE levels despite low eosinophil counts. This discordance suggests the potential for localized airway T helper 2 (Th2)-type inflammation that does not consistently present as peripheral eosinophilia—a phenomenon noted by Bafadhel et al (21) in patients with non-eosinophilic asthma and COPD, where local allergic responses and mast cell activation can elevate IgE without systemic eosinophilia. The significant variation in platelet counts in our study likely reflects conflicting processes. Acute bacterial infections, such as pneumonia, often induce thrombocytosis through pro-inflammatory cytokine stimulation, while thrombocytopenia may occur in patients with severe sepsis or underlying malignancies (22,23). Our finding of mild subclinical anemia aligns with observations in patients with chronic diseases such as COPD and cancer, where anemia of chronic disease is a well-documented comorbidity contributing to poor prognosis and impaired functional status (24,25).

Notably, the active infection rate for *L. blattarum* was only 4.3%, suggesting a limited pathogenic role of this protozoan in the respiratory conditions observed. Previous studies have similarly indicated that *L. blattarum* infections are rare and often opportunistic, typically occurring in the presence of other predisposing factors (4,26). In most positive cases, the parasite burden was mild to moderate, suggesting that *L. blattarum* may function more as an opportunistic colonizer than as a primary pathogen. Evidence underscores the significance of host factors, such as immunosuppression, co-infections, and environmental conditions, in facilitating infection (27,28).

Although over half of the patients in this study reported domestic exposure to mites or cockroaches, the low prevalence of active infection indicates that environmental exposure alone is insufficient to establish clinical disease. This reinforces the notion that host immunity is crucial in determining whether exposure leads to colonization or active infection. Furthermore, the low sensitivity of direct smear microscopy for detecting *L. blattarum*, along with the potential for high false-negative rates, highlights the necessity for more advanced diagnostic methods, emphasizing the superior sensitivity and specificity of molecular techniques such as polymerase chain reaction (PCR) and specialized culture methods (29).

## Conclusion

This study demonstrates that while *L. blattarum* can be detected in patients with respiratory conditions, its direct role as a primary pathogen in this context appears limited. The clinical and laboratory profiles suggest that bacterial infections and chronic respiratory diseases are the primary contributors to patients' symptoms. Environmental exposures and smoking likely exacerbate this burden; however, the low prevalence of active *L. blattarum* infection indicates that it may act more as an opportunistic organism in susceptible individuals rather than a major cause of respiratory illness. These findings accentuate the importance of prioritizing accurate diagnosis and appropriate treatment for more prevalent infectious and chronic respiratory conditions, while considering *L. blattarum* as a possible, but less significant, co-factor.

## Limitations of the study

Despite the valuable insights gained, the study has several limitations. Sensitivity of diagnostic methods; the study utilized direct light microscopy for the detection of *L. blattarum*, a method recognized for its limited sensitivity and specificity. Misidentification with bronchial ciliated epithelial cells may have resulted in an under- or overestimation of actual infection rates. Furthermore, the absence of follow-up data limits the ability to assess clinical outcomes post-diagnosis, thereby hindering the evaluation of the parasite's impact on disease progression or treatment response.

### Authors' contribution

**Conceptualization:** Mohsen Farrokhpour, Mahdi Azimi, Niloofar Keikhaei.
**Data curation:** Mohsen Farrokhpour, Mahdi Azimi, Niloofar Keikhaei.
**Formal analysis:** Mehran Beheshti, Maryam Alsadat Baniaghil, Negin Rahimzadeh.
**Funding acquisition:** Mohsen Farrokhpour, Mahdi Azimi, Niloofar Keikhaei.
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**Methodology:** Mohsen Farrokhpour, Mahdi Azimi, Niloofar Keikhaei, Mehran Beheshti, Seyedeh Hatameh Asadinejad Tahergourabi.
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**Software:** Maryam Alsadat Baniaghil, Negin Rahimzadeh.
**Supervision:** Mohsen Farrokhpour, Mahdi Azimi, Niloofar Keikhaei.
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**Visualization:** Maryam Alsadat Baniaghil, Negin Rahimzadeh.
**Writing–original draft:** Maryam Alsadat Baniaghil, Negin Rahimzadeh, Seyedeh Hatameh Asadinejad Tahergourabi.
**Writing–review & editing:** Mohsen Farrokhpour, Mahdi Azimi, Niloofar Keikhaei, Seyedeh Hatameh Asadinejad Tahergourabi.

## Conflicts of interest
The authors declare no conflict of interest.

## Ethical issues
The research conducted in this study adhered to the principles outlined in the Declaration of Helsinki and received approval from the Ethics Committee of Iran University of Medical Sciences (Ethical code #IR.IUMS.FMD.REC.1403.363). Prior to any intervention, all participants provided written informed consent. This study is based on the fellowship thesis by Seyedeh Hatameh Asadinejad Tahergourabi from the Department of Internal Medicine at the university (Thesis #1403-31882). The authors have maintained ethical standards, ensuring the absence of plagiarism, data fabrication, or duplicate publication.

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