# The Relationship Between Characteristics of Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease (COPD) Hospitalized with Blood Eosinophil Levels at Waled Regional Hospital in September 2023-September 2024

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***Abstract***.

*Chronic obstructive pulmonary disease (COPD) is a chronic respiratory disorder with persistent airflow limitation and prone to acute exacerbations, in which blood eosinophil levels have been proposed as a marker of type 2 inflammation and response to therapy. This study aimed to determine the relationship between clinical-demographic characteristics of patients with acute exacerbations of COPD hospitalized at Waled Regional Hospital and blood eosinophil levels during the period of September 2023–September 2024. This study was a quantitative observational analytical study with a cross-sectional design conducted on 132 inpatients with exacerbations of COPD who met the inclusion criteria based on medical records, including diagnosis, first-time blood eosinophil laboratory results, and the absence of active helminth infections. Data were collected retrospectively from medical records and analyzed using univariate descriptive statistics and Spearman's rank correlation test in SPSS. The results showed that 62.1% of patients were male, 68.9% were aged ≥60 years, 75.0% had normal eosinophils (0–300 cells/μL), and 25.0% had elevated eosinophils (>300 cells/μL). Statistical tests found a significant but weak association between male gender and blood eosinophil levels ($p = 0.023$, $rs = 0.198$), while no significant association was found between age or occupational history and eosinophil levels. The results showed that in this regional referral hospital setting, elevated eosinophils were more common in male patients with acute exacerbation of COPD, while age and occupation did not show a significant association. The conclusions of the study underscore the need for larger prospective studies to clarify the role of eosinophils as a marker of severity and response to therapy in low-middle-income areas.*

***Keywords:*** *Blood Eosinophil; COPD Exacerbation; Cross Sectional Study; Eosinophil Level and Hospitalized Patient.*

## I. INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a heterogeneous lung disorder characterized by chronic respiratory symptoms such as shortness of breath, cough, and sputum production due to disorders of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent and often progressive airflow obstruction (Celli et al., 2022)(GOLD, 2023). Acute exacerbation of COPD (COPDEA) is described as an episode of increasing shortness of breath and/or cough with increased volume and color of sputum for <14 days, accompanied by tachypnea and/or tachycardia due to local or systemic inflammation, often indicating hospitalization in patients with severe COPD. COPD is currently one of the three leading causes of death globally, with 3.23 million deaths in 2019 and is expected to rise to the third leading cause of death in the next decade after cardiovascular disease and cancer (WHO, 2022)(GBD, 2020).Globally and nationally, the main risk factor for COPD is exposure to inhalation of harmful particles and gases, especially cigarette smoke, both active and passive, which is thought to be involved in 85–95% of cases in adult men and is dose-response related to the duration and intensity of smoking (Celli et al., 2022)(WHO, 2022). In Indonesia, the prevalence of COPD based on the 2018 Basic Health Research reached 3.7% nationally and 11% in West Java, with a predominance in men and a close relationship to exposure to dust, outdoor and indoor air pollution, and a history of recurrent respiratory tract infections in childhood (Ministry of Health, 2018)(Ikawati, 2022).

In addition, recent studies have shown that occupational exposure to vapors, gases, dusts, and fumes increases the risk of impaired lung function and COPD, and there is a correlation between PM2.5/10 particulate levels and the prevalence of COPD in the working population (Liu et al., 2021)(NIOSH, 2022).At the pathophysiological level, airway inflammation in COPD involves not only neutrophil inflammatory cells, but also eosinophils, which act as biomarkers of type 2 (T2) inflammation. Eosinophils are granulocytes derived from the bone marrow, with normal numbers below 5% of circulating leukocytes and tend to be

100–400 eosinophils/µL in healthy adults, so eosinophilia is generally defined when the count exceeds 500 eosinophils/µL (Blanchard & Rothenberg, 2022) (Nair et al., 2023). COPD patients with higher blood eosinophil counts show increased type 2 inflammation, increased T2 inflammatory biomarkers, and thickening of the bronchial reticular basement membrane, so blood eosinophil levels are often considered a reflection of the degree of eosinophilic lung inflammation (Singh et al., 2022) (Nair et al., 2023). Prospective studies in endemic populations with parasitic infections reported that COPD patients with blood eosinophils ≥300 cells/µL had higher hospitalization rates but lower mortality, as well as clinical values that could be used as predictors of exacerbations (Juthong & Kaenmuang, 2020) (Guan et al., 2022).

In addition, recent cohort and case-control studies have shown that COPD patients with higher blood eosinophils tend to have more T2 inflammatory infarcts, experience more eosinophilic exacerbations, and require more systemic or inhaled corticosteroid therapy (Singh et al., 2022) (Fahyim et al., 2024). A retrospective cohort study of patients with a history of COPD exacerbations in the past year found that the group with “fluctuating” blood eosinophils had a longer hospital stay and a positive correlation between the number of exacerbations and eosinophil levels and eosinophils per WBC, making blood eosinophil variability an important indicator in determining therapeutic strategies (Fahyim et al., 2024) (Nair et al., 2023). On the other hand, a case-control study in Indonesia reported that the number of eosinophils and IgE in blood and saliva was higher in COPD patients compared to control groups of smokers and non-smokers, proving that eosinophils and IgE can act as biological markers of inflammation in COPD (Sitanggang et al., 2022) (Nair et al., 2023).Based on this phenomenon, there are not many studies that specifically examine the relationship between demographic and clinical characteristics of hospitalized patients with acute exacerbations of COPD (gender, age, occupational history, dust/cigarette exposure) and blood eosinophil levels in the Indonesian hospital context, particularly at Waled Regional General Hospital (RSUD), West Java. However, a better understanding of the pattern and magnitude of eosinophilia in COPD patients can help predict severity, risk of recurrent exacerbations, and response to ICS or steroid therapy, thus having high clinical and operational relevance in respiratory medicine services (Singh et al., 2022) (Fahyim et al., 2024).

Furthermore, local research at Waled Regional General Hospital will provide more accurate epidemiological data for the Indonesian context, which can form the basis for developing screening, education, and preventive interventions in populations at high risk of dust and cigarette exposure (Kang et al., 2021) (Nair et al., 2023).In this context, this study aims to determine the relationship between the characteristics of patients with acute exacerbations of COPD hospitalization and blood eosinophil levels at Waled Regional Hospital from September 2023 to September 2024, focusing on gender, age, occupational history, and eosinophilia profile. In general, this study is expected to provide scientific information that can be used as a basis for developing management protocols, improving service quality, and educating the public about the importance of controlling COPD risk factors and monitoring eosinophils as a biomarker of inflammation. The novelty of this study lies in the combination of demographic and occupational characteristics of COPD-EA patients with blood eosinophil analysis at a regional referral hospital. This differs from previous studies that generally focused more on eosinophils as a biological marker or exacerbation without comprehensively linking them to sociodemographic and occupational characteristics in the Indonesian setting (Juthong & Kaenmuang, 2020) (Kang et al., 2021) (Sitanggang et al., 2022).

## II. METHODS

The type and method of research in this study is quantitative research with an analytical observational approach, using a cross-sectional design to examine the relationship between the characteristics of patients with acute exacerbation of chronic obstructive pulmonary disease (COPD) hospitalizations with blood eosinophil levels at the Waled Regional General Hospital (RSUD), West Java (Creswell & Creswell, 2022) (Ministry of Health of the Republic of Indonesia, 2023). This research is within the scope of Internal Medicine, Respiratory Pulmonology, and Clinical Pathology, so the data studied include clinical aspects, demographics, and blood laboratory parameters, especially absolute eosinophil counts

(PDPI, 2021) (Sundar, 2023). The cross-sectional design was chosen because the researcher wanted to obtain data on independent variables (patient characteristics) and dependent variables (blood eosinophil levels) at one time without performing any intervention, thus enabling correlation analysis in patients with acute exacerbation of COPD who had been exposed to various risk factors (Sugiyono, 2022) (Creswell, 2023).

The instruments and data analysis techniques of this study centered on secondary data in the form of medical records, which were then processed using Excel and SPSS software for processing and statistical testing purposes (Sugiyono, 2022) (Johnson & Christensen, 2023). The main instrument used was a clinical-demographic questionnaire instrument stored in the medical record, in the form of patient identity, gender, age, employment history, and the first blood eosinophil laboratory results during acute COPD exacerbation (Emzir, 2023) (Ministry of Health, 2023). The analysis technique used was univariate analysis to describe the distribution and description of the characteristics of each variable (frequency, proportion, percentage), and bivariate analysis using the Spearman rank correlation test to assess whether there was a relationship between patient characteristics (gender, age, employment history) and blood eosinophil levels, with a significance limit of $p < 0.05$ (Creswell, 2023) (Johnson & Christensen, 2023).The research population and sample were systematically determined according to contemporary health research methodology (Sugiyono, 2022; Sudaryono, 2023). The target population was all inpatients with acute exacerbation of COPD who had medical records at Waled Regional Hospital, while the accessible population was inpatients with acute exacerbation of COPD with blood eosinophil laboratory results from September 2023 to September 2024 according to the period specified in the research proposal (Ministry of Health, 2023) (Johnson & Christensen, 2023).

The sample was obtained through a nonprobability sampling technique, with a total sampling approach, so that the entire accessible population during that time period was sampled without randomization, considering the limited flexibility and uniformity of information in retrospective medical record data (Sugiyono, 2022) (Sudaryono, 2023). Inclusion criteria included medical records of patients with a diagnosis of acute exacerbation of COPD hospitalization and first-time blood eosinophil laboratory results, while exclusion criteria included COPD patients with helminth infections to avoid distortion by parasitic eosinophilia (Sundar, 2023) (Nair et al., 2022).The research procedure was systematically designed following the classic stages in quantitative research methodology (Creswell, 2023) (Emzir, 2023). The initial stage includes problem identification, preliminary studies, problem formulation, hypothesis development, and determination of variables and data sources. This was followed by the submission of ethical clearance and approval from the Waled Regional General Hospital research ethics committee in accordance with medical record-based research ethics regulations (Creswell, 2023) (Ministry of Health, 2023). In the field stage, researchers collected medical record data from inpatient acute exacerbation COPD patients from September 1, 2023–September 1, 2024, then edited, coded, input, and cleaned the data to ensure suitability and consistency before analysis. After the univariate and bivariate analyses were completed, researchers compiled a research report which was then presented in the form of a scientific paper as one of the academic requirements, ensuring compliance with research ethics and patient data protection (Creswell, 2023) (Sugiyono, 2022).

## III. RESULT AND DISCUSSION

### Univariate Analysis

**Table 1.** Gender Description of COPD Patients with Acute Exacerbation

| No | Gender | n | % |
|---|---|---|---|
| 1 | Woman | 50 | 37.9 |
| 2 | Man | 82 | 62.1 |
| | Total | 132 | 100 |

The data in the table above shows that the characteristics of respondents based on gender are mostly male, namely 82 people (62.1%) and female, namely 50 people (37.9%).

**Table 2.** Age Description of COPD Patients with Acute Exacerbation

| No | Age | n | % |
|---|---|---|---|
| 1 | Adult Age (18-59 years) | 41 | 31.1 |
| 2 | Elderly (>60 years) | 91 | 68.9 |
| | Total | 132 | 100 |

The data in the table above shows that the characteristics of respondents based on age are mostly elderly (>60 years), namely 91 people (68.9%) and the least are adults (18-59 years), namely 41 people (31.1%).

**Table 3.** Overview of the Occupational History of COPD Patients with Acute Exacerbation

| No | Job Riw | n | % |
|---|---|---|---|
| 1 | Farm workers | 6 | 4.5 |
| 2 | Construction workers | 41 | 31.1 |
| 3 | Employee | 0 | 0.00 |
| 4 | Housewife | 36 | 27.3 |
| 5 | Other* | 49 | 37.1 |
| | Total | 132 | 100 |

| Other | n | % |
|---|---|---|
| Self-employed | 37 | 75.51 |
| Retired | 5 | 10.20 |
| Doesn't work | 7 | 14.29 |
| Total | 49 | 100 |

The data in the table above shows that the characteristics of respondents based on their work history are that the majority are construction workers, 41 people (31.1%), housewives, 36 people (27.3%), and farm laborers, 6 people (4.5%).

**Table 4.** Description of Blood Eosinophils in Patients with Exacerbated COPD

| No | EOS | n | % |
|---|---|---|---|
| 1 | Normal 0-300 | 99 | 75.0 |
| 2 | Increased >300 | 33 | 25.0 |
| | Total | 132 | 100 |

The data in table 4 shows that the eosinophils in most respondents were normal (0-300) as many as 99 people (75.0%) and those who experienced an increase were 33 people (25.0%).

**Bivariate Analysis**

**Table 5.** Relationship between Gender of Acute Exacerbation COPD Patients and Blood Eosinophil Levels

| Gender | EOS | | | | P value | Rs |
|---|---|---|---|---|---|---|
| | Normal | | Increase | | | |
| | n | % | n | % | | |
| Woman | 43 | 32.5 | 7 | 5.3 | 0.023 | 0.198 |
| Man | 56 | 42.5 | 26 | 19.7 | | |
| Total | 99 | 75.0 | 33 | 25 | 132 | |

The data in the table above shows that out of 82 male respondents, 56 people (42.5%) had normal eosinophils and 26 people (19.7%) had increased eosinophil levels. Out of 50 female respondents, 43 people (32.5%) had normal eosinophils. The results of the Spearman rank statistical test obtained a p value of 0.023. This means that there is a relationship between the gender of acute exacerbation COPD sufferers and blood eosinophil levels at Waled Regional Hospital. From these data, a correlation value of 0.198 was obtained, meaning that the accuracy of the influence of gender on blood eosinophil levels is very weak.

**Table 6.** Relationship Between the Age of Acute Exacerbation COPD Patients and Blood Eosinophil Levels

| Age | EOS | | | | P value | Rs |
|---|---|---|---|---|---|---|
| | Normal | | Increase | | | |
| | n | % | N | % | | |
| Adult Age (18-59 years) | 28 | 68.3 | 13 | 31.7 | 0.235 | -0.104 |
| Elderly (>60 years) | 71 | 78.0 | 20 | 22 | | |
| Total | 99 | 75.0 | 33 | 25.0 | 132 | |

The data in the table above shows that elderly respondents (>60 years) had more normal eosinophils, as many as 71 people, and in adults (18-59 years) who had normal eosinophil levels were 28 people (68.3%). The results of the Spearman rank statistical test obtained a p value of 0.235. This means that there is no relationship between the age of acute exacerbation COPD patients and blood eosinophil levels at Waled Regional Hospital. From these data, a correlation value of -0.104 was obtained, meaning that the accuracy of the effect of age on blood eosinophil levels is very weak.

**Table 7.** Relationship between Occupation of Acute Exacerbation COPD Patients and Blood Eosinophil Levels

| Job Riw | EOS | | | | P value | rs |
|---|---|---|---|---|---|---|
| | Normal | | Increase | | | |
| | n | % | n | % | | |
| Farm workers | 4 | 3.03 | 2 | 1.5 | 0.416 | 0.051 |
| Construction workers | 28 | 21,22 | 13 | 9.8 | | |
| Housewife | 30 | 22.72 | 6 | 4.5 | | |
| Other | 37 | 28.03 | 12 | 9.2 | | |
| Total | 99 | 75.0 | 33 | 25 | 132 | |

The data in the table above shows that respondents who work as farm laborers mostly have normal eosinophils, as many as 4 people (3.03%), working as construction workers mostly have normal eosinophils as many as 28 people (21.22%), working as housewives mostly have normal eosinophils as many as 30 people (22.72%), working other jobs mostly have normal eosinophils as many as 37 people (28.03%). And in the history of construction workers' work, most of the eosinophil levels increased with a number of 13 people (9.8%). The results of the Spearman rank statistical test obtained a p value of 0.416. This means that there is no relationship between the work of acute exacerbation COPD sufferers and Blood Eosinophil Levels at Waled Regional Hospital. From these data, a correlation value of 0.051 was obtained, meaning that the accuracy of the influence of work on Eos is very weak.

**Discussion**

*1. Relationship between Gender and Eosinophil Levels*

The results of the study showed that 82 male respondents had more normal eosinophils, as many as 56 people (42.5%) and those with increased eosinophil levels were 26 people (19.7%), of the 50 female respondents, 43 people (32.5%) experienced normal eosinophils. The results of the Spearman rank statistical test obtained a p value of 0.023. This means that there is a relationship between the gender of patients with acute exacerbation of COPD hospitalization and blood eosinophil levels at Waled Regional Hospital. Looking at the data in general, there is a difference in eosinophil counts between men and women. Men tend to have higher normal eosinophil counts than women.Elevated eosinophils indicate that men with COPD have a higher average eosinophil count than women. Analysis of current eosinophil counts based on NHANES data suggests that an individual's demographic and clinical characteristics can influence blood eosinophil counts, which may be particularly important to consider when focusing on absolute eosinophil thresholds (e.g., >150 cells/mL, >300 cells/mL, >400 cells/mL) for determining elevated eosinophil counts. For all 3 populations evaluated (individuals with asthma, individuals with COPD, and non-asthmatic/COPD controls), eosinophil counts were higher in men than in women. (38)In the study by Mei Yang et al., our results also showed that there were variations in eosinophil levels that could be influenced by gender, indicating that gender differences may play a role in the inflammatory response in COPD patients.

(36,37) This is in accordance with the journal written by Sylvia Hartl, et al. with the title Blood eosinophil count in the general population: typical values and potential confounders, which states that the number of eosinophils is higher in men than in women in all age groups. (39) This can be caused by being associated with various factors, including a history of smoking, frequent exposure to dust and smoke from the work environment or vehicles. (39) Based on research by Yanan Cui et al., it was stated that among 900 patients whose eligibility was assessed, 530 patients were included and followed up in this study. At admission, blood eosinophil levels were <300 cells/µl in 440 patients (83.0%), of which 59 (13.4%) were discharged with elevated blood eosinophils. The average age of the study population was 68 years and 91.1% were male.(40) Based on this description, it can be concluded that the percentage of COPD patients is higher in

men. This may be due to the male gender's tendency to smoke or be exposed to pollution. Cigarette smoke and dust can cause damage to the airways, increasing the risk of COPD. Eosinophils play a role in airway inflammation, and high eosinophil levels can be a result of these respiratory tract disorders.

*2. Relationship between Age and Eosinophil Levels*

Based on the research results, respondents aged >60 years were more likely to have normal eosinophils, as many as 71 people, while respondents in early adulthood had more normal eosinophils, as many as 28 people. The results of the Spearman rank statistical test obtained a p value of 0.235. This means there is no relationship between the age of patients with acute exacerbation of COPD hospitalization and blood eosinophil levels at Waled Regional Hospital.Looking at the data indicates that eosinophil levels are in normal conditions as the respondent's age increases, meaning there is no statistically significant difference in the normal eosinophilia group and increases between the four age groups. This means that in this study, normal eosinophil cases were experienced by all age groups. Based on research by Sylvia Hartl, et al., it states that the number of eosinophils in the blood reaches its peak during infancy and adolescence, then becomes stable and is no longer influenced by age after a person reaches 18 years of age, both in men and women. (39) In a healthy population aged 18 years and over, circulating eosinophil levels tend to be lower than commonly used clinical reference values, with a median value (5%–95% confidence interval) of 120 (30–330) cells/μL in men and 100 (30–310) cells/μL in women.

(39) Several things related to age and COPD based on a journal written by Amr Albana, et al. in his research stated that patients with low blood eosinophil levels tend to experience more symptomatic COPD exacerbation episodes, although with a lower likelihood of visiting the emergency unit before the first exacerbation. COPD exacerbations are known to be associated with systemic inflammation that is often triggered by bacterial infections as well as inflammation of the respiratory tract. (41) That 31.1% of patients showed positive results for microorganisms (PPM) upon hospital admission, and about 50% of them remained PPM-positive, indicating bacterial persistence. This study concluded that bacterial infections play a role in increasing the frequency of exacerbations, strengthening the suspicion that bacteria have an important contribution to inflammation and exacerbations (41). In addition, long-term observational studies revealed that blood eosinophil levels below 100 cells/μL are associated with a higher risk of pneumonia and persistent bacterial respiratory tract infections. COPD patients with low eosinophil levels are more susceptible to bacterial infections, although the biological mechanisms behind this phenomenon are still not fully understood.

(42) In a study by Mei Yang et al. entitled "Clinical Predictors of High Blood Eosinophils in Chronic Obstructive Pulmonary Disease," it was stated that this relationship existed through a multivariate analysis of blood eosinophil levels. (43) Advanced age is recognized as an important factor that plays a role in the development, progression, and exacerbation of COPD. In this cohort study, we found that elderly patients tended to have higher blood eosinophil levels. This finding is consistent with two previous cross-sectional studies that showed that COPD patients with higher eosinophil levels were generally older. However, two other studies reported different results, namely no significant relationship between age and eosinophil levels. (42,43)Based on this description, it can be argued that the absence of this relationship is inseparable from comorbidities or diseases experienced. Certain diseases (asthma, COPD, allergies) can increase eosinophil levels, independent of age. Furthermore, it is related to the use of medications (e.g., corticosteroids), which can decrease eosinophil levels and are often used more frequently in the elderly. Furthermore, changes in the immune system with age affect the number and activity of eosinophils. The relationship between age and eosinophil levels is complex and influenced by many factors. In general, eosinophil levels tend to be higher in the elderly as the immune system declines, but certain diseases in the elderly can cause eosinophils to increase again.

*3. Relationship between work history and eosinophil levels*

The results of the study showed that respondents who worked as farm laborers mostly had normal eosinophils (83.3%), working as construction workers mostly had normal eosinophils (67.3%), working as housewives mostly had normal eosinophils (83.3%), working in other jobs mostly had normal eosinophils (73.2%), The results of the Spearman rank statistical test obtained a p value of 0.416. This means that there is

no relationship between the work of patients with acute exacerbation of COPD hospitalization and blood eosinophil levels at Waled Regional Hospital.The data shows that both employed and unemployed COPD patients, such as housewives, have normal eosinophil levels, with only a few in these occupations experiencing elevated levels. Furthermore, looking at the distribution of occupations among residents of Cirebon Regency, particularly those around Waled Regional Hospital, the majority of them work in agriculture, trade, housewives, and self-employment.

Some jobs, such as those in agriculture, can expose people to dust or pollen that can cause allergies. According to Chattopadhyay et al., their research found that workers exposed to wheat dust had higher blood eosinophil levels, especially in the quality control group. These increased eosinophil levels were associated with impaired lung function, including decreased lung volume and expiratory flow, suggesting a relationship between occupational exposure and changes in eosinophil levels. (44) Based on Narayanasamy's research, construction sites not only produce large amounts of fine dust, but also volatile organic compounds, hydrocarbons, sulfur dioxide, silicon dioxide, carbon monoxide, and lead. This PM10 construction dust is invisible to the naked eye and includes silica, asbestos, inorganic dust fumes, asphalt, nitrogen oxides, sulfur, carbon, and cement dust. Workers on construction sites are directly exposed to these pollutants which have a negative impact on their health. Studies have documented an increase in the incidence and frequency of respiratory disorders, inflammation, and chronic obstructive and restrictive lung diseases in construction workers from various geographic locations. COPD develops due to prolonged exposure to irritants/pollutants resulting in alveolar damage, while ARDS develops due to sudden infections such as trauma that cause the accumulation of inflammatory fluid. (45) According to research by Kurniasih et al., in their research, it was shown that residents living close to coal storage areas had eosinophil levels within normal limits, but tended to be higher in men, those living within ≤500 meters of the stockpile, and those who had lived there for ≥10 years. This indicates the potential impact of exposure to the work environment on eosinophil levels.

(46) This is especially true in jobs exposed to allergens, such as mine dust, or jobs involving contact with certain chemicals that can trigger allergic reactions or inflammation, which in turn increases the number of eosinophils.Exposure to and use of biomass fuels (firewood, charcoal, garbage) or household air pollution is associated with COPD in resource-poor areas of low- and middle-income countries, and is associated with higher levels of disease severity and lung function at risk for COPD. (47) The association between domestic pollution and COPD is stronger in women, due to their longer stay indoors and repeated household activities >10–20 years. (47) Housewife work such as in the field of non-domestic cleaning work, washing dishes, cooking (inhaling steam, gas or smoke), using cleaning products, bleaching products (chlorine, ammonia), irritant gases increases the risk of exposure to COPD due to damage to the respiratory tract epithelium and chronic obstructive airway inflammation.(48) Several factors to consider regarding work-related issues include personal hygiene and the use of PPE. Better personal hygiene and the use of PPE, particularly masks, can prevent respiratory tract disorders, leading to normal eosinophil levels in COPD patients.Based on this description, there is no relationship between occupation and blood eosinophil levels. Eosinophils, a type of white blood cell, play a role in fighting parasitic infections and allergies, as well as being involved in inflammation. Blood eosinophil levels are more influenced by health conditions such as infections, allergies, or autoimmune diseases, rather than a person's type of occupation.

## IV. CONCLUSION

Based on the results of the study, the relationship between the characteristics of patients with acute exacerbation of COPD hospitalization and blood eosinophil levels showed that the majority of respondents were male (62.1%), elderly (68.9%), and most had a history of work as construction workers, housewives, and other jobs (self-employed, retired, and unemployed). At the eosinophil level, most patients had blood eosinophil levels in the normal range (0–300 µL, 75.0%), while 25.0% experienced an increase in eosinophils >300 µL. Bivariate analysis using the Spearman rank test showed a significant relationship between gender and blood eosinophil levels ($p = 0.023$, $rs = 0.198$), although the strength of the correlation was very weak, while no significant relationship was found between age and work history with blood eosinophil levels ($p = 0.235$ and $p = 0.416$). This finding is in accordance with the literature showing that

blood eosinophils are higher in men than in women, and can be influenced by exposure to cigarettes, dust, and air pollution, but is not consistently related to age or type of work.

Several limitations of this study should be noted, namely the cross-sectional design, which cannot demonstrate causality, and the reliance on retrospective medical record data, which may introduce information and selection bias. Furthermore, the sample size and the regional context of Cirebon Regency limit the generalizability of the findings to other types of hospital settings and populations in other provinces or regions. Further research using a prospective cohort design is recommended to assess changes in eosinophils over time and their association with recurrent exacerbations, as well as incorporating more in-depth clinical variables such as COPD severity index, asthma history, helminth exposure, and use of ICS/steroid therapy. The practical implication of this study is that physicians and healthcare workers at Waled Regional Hospital may consider monitoring blood eosinophils in patients with acute COPD exacerbations, particularly in men, as part of their respiratory inflammation risk assessment. Although this association remains weak and needs to be confirmed by larger, longitudinal studies.

**REFERENCES**


[1] Albanna, A., Almuyidi, FM, Beitar, NF, Alshumrani, AS, Al Nufaiei, ZF, & Khayat, R. (2022). Clinical characteristics and outcomes related to blood eosinophilic chronic obstructive pulmonary disease (COPD) patients. Cureus, 14(1), e21045. https://doi.org/10.7759/cureus.21045

[2] Antariksa, B., Bahtiar, A., & Wiyono, WH (2023). Guidelines for the diagnosis and management of COPD (Chronic Obstructive Pulmonary Disease). Indonesian Pulmonary Physician Association.

[3] Agarwal, A.K., Raja, A., & Brown, B. (2024). Chronic obstructive pulmonary disease. In StatPearls. StatPearls Publishing.https://www.ncbi.nlm.nih.gov/books/NBK559281/

[4] Chattopadhyay, B. P. (2023). Blood eosinophil levels and ventilatory pulmonary function among workers exposed to grain dust. ***Indian Journal of Occupational and Environmental Medicine***, 27(2), 134–140.

[5] Chipps, B.E., Jarjour, N., Calhoun, W.J., Iqbal, A., Haselkorn, T., & Yang, M. (2021). Stability of blood eosinophil levels in patients with respiratory disease. Annals of the American Thoracic Society, 18(12), 1978–1987. https://doi.org/10.1513/AnnalsATS.202101-015OC

[6] Creswell, J. W., & Creswell, J. D. (2022). Research design: Qualitative, quantitative, and mixed methods approaches (6th ed.). SAGE Publications.

[7] Creswell, J. W. (2023). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (6th ed.). Pearson.

[8] Cui, Y., Zhang, W., Ma, Y., Zhan, Z., & Chen, Y. (2021). Stability of blood eosinophils in acute exacerbation of COPD and its relationship to clinical outcomes. Respiratory Research, 22(1), 1–10. https://doi.org/10.1186/s12931-021-01656-2

[9] Emzir. (2023). Educational research methodology: Quantitative and qualitative. Rajawali Press.

[10] Fahyim, SMM, Abdel Halim, HA, & Hassan, ESSM (2024). Blood eosinophil variability in COPD exacerbations and correlation with treatment plans. ***Egyptian Journal of Bronchology***, 18(1), 1–9.

[11] Global Initiative for Chronic Obstructive Lung Disease (GOLD). (2023). Global strategy for the diagnosis, management, and prevention of COPD.https://www.goldcopd.org

[12] Hartl, S., Breyer, M.K., Burghuber, O.C., Ofenheimer, A., Schrott, A., & Urban, M.H. (2020). Blood eosinophil count in the general population: Typical values and confounders. ***European Respiratory Journal***, 55(5), 1901874. https://doi.org/10.1183/13993003.01874-2019

[13] Ikawati, Z. (2022). Epidemiology of chronic obstructive pulmonary disease in Indonesia. ***Indonesian Journal of Respirology,*** 42(1), 12–20.

[14] Johnson, B., & Christensen, L. (2023). Educational research: Quantitative, qualitative, and mixed approaches (7th ed.). SAGE Publications.

[15] Juthong, S., & Kaenmuang, P. (2020). Association between blood eosinophils and COPD exacerbation in parasitic endemic areas. ***Journal of Thoracic Disease***, 12(9), 4868–4876.

[16] Kang, HS, Kim, SK, Kim, YH, Kim, JW, Lee, SH, & Yoon, HK (2021). Association between eosinophilic exacerbation and eosinophil levels in COPD. BMC Pulmonary Medicine, 21(1), 1–9.

[17] Ministry of Health of the Republic of Indonesia. (2018). National report of Riskesdas 2018.

[18] Ministry of Health of the Republic of Indonesia. (2019). National guidelines for medical services for the management of COPD.

[19] Ministry of Health of the Republic of Indonesia. (2023). Guidelines for medical record-based health research.
[20] Liu, S., Zhou, Y., Liu, S., Chen, X., Zou, W., Zhao, D., & Li, X. (2021). Association between occupational exposure and COPD risk. ***International Journal of Chronic Obstructive Pulmonary Disease***, 16, 123–134.
[21] Lommatzsch, M., Nair, P., & Virchow, J. C. (2024). Normal blood eosinophil counts in humans. Respiration, 103(4), 214–216.
[22] MacLeod, M., Papi, A., Contoli, M., Beghé, B., Celli, B.R., & Wedzicha, J.A. (2021). COPD exacerbation fundamentals. Respirology, 26(6), 532–551.
[23] Nair, P., et al. (2023). Eosinophils in COPD and airway inflammation. ***Journal of Allergy and Clinical Immunology***, 151(2), 345–356.
[24] Narayanasamy, N., & Josyula, L. (2024). Occupational exposure to air pollutants and COPD risk in construction workers: A meta-analysis. ***Indian Journal of Occupational and Environmental Medicine***, 28(4), 313–318.
[25] Indonesian Pulmonary Physicians Association. (2021). Guidelines for the diagnosis and management of COPD.
[26] Ritchie, A.I., & Wedzicha, J.A. (2020). Definition and causes of COPD exacerbations. Clinics in Chest Medicine, 41(3), 421–438.
[27] Singh, D. (2020). Blood eosinophils as a biomarker in COPD. Tuberculosis and Respiratory Diseases, 83(3), 185–194.
[28] Singh, D., Agusti, A., Martinez, F.J., Papi, A., Pavord, I.D., & Wedzicha, J.A. (2022). Blood eosinophils and COPD. American Journal of Respiratory and Critical Care Medicine, 206(1), 17–24.
[29] Sitanggang, FT, Sakdiah, S., Simanjuntak, JP, Mustopa, R., & Yuliandari, N. (2022). Eosinophils and IgE as biomarkers in COPD. ***Indonesian Scientific Journal***, 7(7), 1–12.
[30] Sugiyono. (2022). Quantitative, qualitative, and R&D research methods. Alfabeta.
[31] Sundar, K. M. (2023). Eosinophilia. In StatPearls. StatPearls Publishing.
[32] World Health Organization. (2022). Chronic obstructive pulmonary disease (COPD).https://www.who.int
[33] Yang, M., Yang, T., Li, X., Li, D., Liao, Z., & Shen, Y. (2021). Clinical predictors of high blood eosinophils in COPD. ***International Journal of COPD***, 16, 2467–2474.
[34] Yang, M., Lv, Y., Tang, S., Xu, D., Li, D., & Liao, Z. (2024). Blood eosinophil count determinants in population-based cohorts. Respiration, 103(2), 70–78