



Characteristics of Brick Workers and C- Reactive Protein (CRP) Levels Using the Agglutination Method

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ABSTRACT

Chronic exposure to dust in the brick industry work environment has the potential to increase the risk of systemic inflammation and respiratory disorders, which can be identified through C-Reactive Protein (CRP) levels as an inflammation biomarker. This study aims to describe CRP levels in brick industry workers as an early detection step for inflammatory processes and a basis for preventing work-related health risks. In this descriptive study, 40 brick workers in Banyumas Regency were selected based on inclusion and exclusion criteria, with examinations conducted at the Medical Laboratory Technology Laboratory of UMP. CRP levels were measured using the latex agglutination method on blood samples, and data analysis considered respondent characteristics such as use of personal protective equipment (PPE), smoking habits, age, and duration of work. The results showed that most workers did not use PPE (38 people) and had smoking habits (33 people), but the majority showed negative CRP results (39 people), with only 1 worker experiencing elevated CRP at titer 1:2 with a level of 12 IU/mL. This study concludes that most brick industry workers have not experienced acute systemic inflammation, while factors such as age and lifestyle are suspected to play a role in elevated CRP levels in certain individuals.

Keywords : Brick workes; c – reactive protein; inflammation; ppe; smoking

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INTRODUCTION

Dust exposure in the workplace remains a significant occupational health problem, with direct impacts on the respiratory system and immune response of workers. Chronic exposure to dust particles is known to increase the risk of respiratory diseases, systemic inflammation, and various other health disorders. This risk tends to be higher in industrial sectors with limited environmental controls, making dust exposure one of the main causes of occupational health disorders (1).

In Indonesia, the informal industrial sector is still prevalent and serves as a livelihood source for communities, including the brick-making industry. The brick production process, from clay processing, molding, drying, to burning, generates large amounts of dust and smoke at each stage. Workers in this sector generally work long hours with suboptimal use of personal protective equipment, thus increasing the risk of health disorders due to work environment exposure (2).

Dust consists of solid particles originating from mechanical processes and the combustion of organic and inorganic materials, which can be inhaled into the respiratory tract. Long-term exposure to dust can cause various complaints, such as chronic coughing, shortness of breath, and decreased lung function. (3). In addition, these conditions can also increase the risk of Acute Respiratory Infections (ARI), especially among workers operating in environments with poor air quality (4)

Acute Respiratory Tract Infection (ARTI) is an infectious disease that attacks the upper and lower respiratory tract and remains one of the public health problems. ARTI is not only caused by microbial infections, but can also be triggered by exposure to dust and environmental pollutants that cause inflammation in the respiratory tract. This inflammatory process plays an important role in aggravating clinical symptoms and prolonging the duration of the disease. (5).

To assess the presence of inflammation, several laboratory parameters can be used, including procalcitonin (PCT), interleukin-6 (IL-6), and C-reactive protein (CRP) (6). In this study, the parameter used was CRP. CRP is an acute phase protein produced by the liver in response to inflammation or infection in the body. Elevated CRP levels are often used as an early indicator of the onset of inflammation, even before more severe clinical symptoms appear (7).

The CRP test in this study was performed using the latex agglutination method. This method has the advantages of a simple procedure, relatively fast testing time, and does not require complex laboratory equipment, making it widely used as a screening method. The results of the CRP test using the latex agglutination method can provide an initial indication of the presence of inflammation in workers who are at high risk due to occupational exposure. (8).

The inflammatory response in individuals can be influenced by various factors, including age, gender, body mass index, lipid levels, blood pressure, smoking habits, and compliance with the use of personal protective equipment. These factors can exacerbate the inflammatory response caused by exposure to dust in the work environment (9).

Based on this description, brick industry workers are a group at high risk of health problems due to exposure to dust and suboptimal working conditions. Therefore, this study aims to determine the levels of C-reactive protein (CRP) in brick industry workers as an effort to detect early signs of inflammation.

METHODS

This study was conducted on brick manufacturing workers in Banyumas Regency. Sampling was carried out using a sampling technique based on specific criteria, namely respondents who met the inclusion and exclusion criteria from all brick workers. The study was conducted in November 2025 at the Microbiology Laboratory of the TLM Study Program,

Muhammadiyah University Purwokerto. The determination of C-reactive protein (CRP) levels in the respondents serum was performed using the latex agglutination method. The test was carried out by adding 50 μ L of serum to a black test plate, followed by one drop of CRP latex reagent (Glory), then stirred using a stirring rod until homogeneous and rotated for about 2 minutes to observe agglutination.

To ensure the accuracy of the results, internal quality control was performed using positive and negative control sera. Samples that showed agglutination were then diluted using physiological NaCl to determine the titer value. A titer $\geq 1:2$ with a value of 6 IU/mL was considered positive, while the absence of agglutination indicated a negative result. Each sample was examined once according to the manufacturer's instructions. The CRP test results were then analyzed descriptively and presented in the form of a frequency distribution table to illustrate the CRP levels in brick industry workers based on respondent characteristics, including age, length of service, smoking habits, and use of personal protective equipment (PPE).

RESULTS

The characteristics of respondents in this study included the use of PPE, smoking habits, length of employment, and age of the brick manufacturing industry in Banyumas Regency. The distribution of respondent characteristics is presented in Table 1.

Table 1. Based on CRP Test Results

Negative	0	0	39
CRP Result Positive	Titer 1:2	Level 12 IU/mL	Amount 1

Source : Primary Data, 2025

Based on Table 1, the results of C-Reactive Protein (CRP) tests on 40 brick manufacturing industry workers showed that most respondents had negative CRP results. A total of 39 people (97.5%) showed negative CRP results with a titer of 0, while only 1 person (2.5%) showed positive CRP results with a titer of 1:2 and a CRP level of 12 IU/mL. This indicates that the majority of workers did not experience acute systemic inflammation at the time of examination.

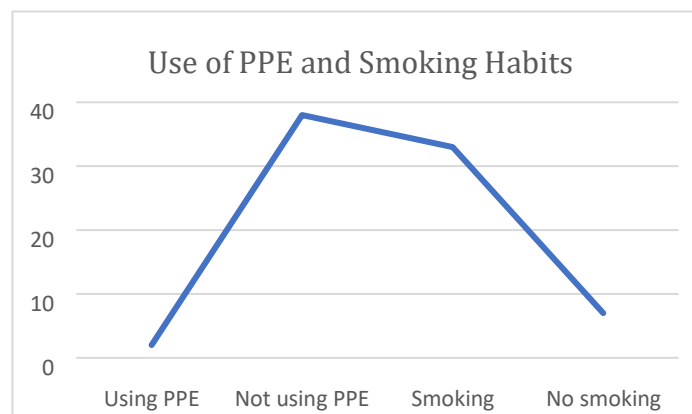


Figure 1. Graph of PPE Use and Smoking Habits

Source: Primary Data, 2025

Based on graph 1, most brick workers in this study did not use personal protective equipment (PPE) while working. Of the total 40 brick workers, 38 (95%) did not use PPE, while only 2 (5%) did. In addition, it appears that the majority of brick workers smoke. A total of 33 brick workers (82.5%) were known to smoke, while only 7 (17.5%) did not smoke. This shows that low PPE use and high smoking habits are still the main characteristics of brick workers in this study.

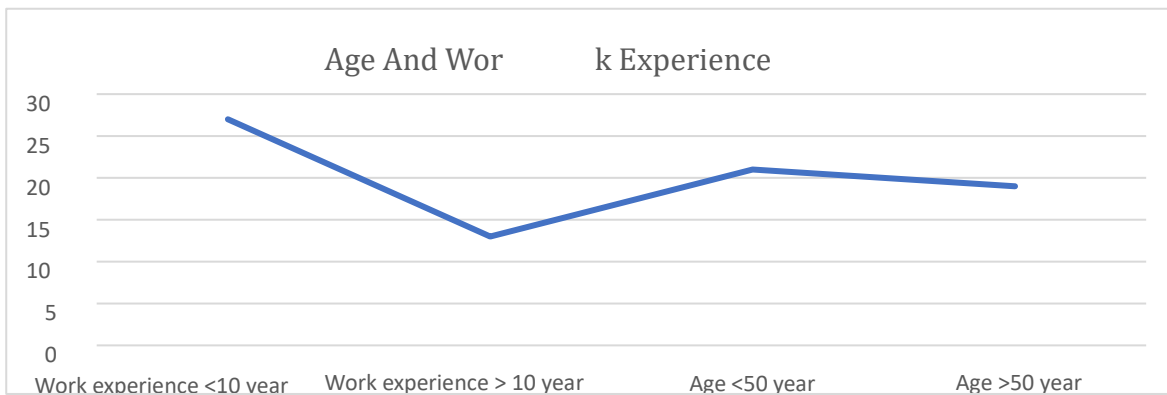


Figure 2. Graph of Age and Length of Service

Source: Primary Data, 2025

Based on graph 2, the characteristics of brick workers based on length of service show that most workers have less than 10 years of service, namely 27 people (67.5%), while workers with more than 10 years of service number 13 people (32.5%). Meanwhile, based on age group, the majority of brick workers are under 50 years old, totaling 21 people (52.5%), while workers over 50 years old number 19 people (47.5%). This shows that most brick workers are still of productive age with relatively short working periods.

DISCUSSION

C-Reactive Protein (CRP) is an inflammatory biomarker produced in response to tissue or organ damage. In such conditions, the body responds by secreting acute phase proteins as markers of inflammation (10). Elevated CRP levels can occur in various inflammatory and tissue necrosis conditions, whether caused by infection or non-infection. CRP is an acute systemic inflammatory marker produced by the liver and is often found to be elevated in various diseases, including diabetes mellitus and cardiovascular events, although

the exact mechanism of CRP involvement in these conditions is not yet fully understood (11). Based on the results of a study of 40 serum samples from brick industry workers in Banyumas Regency, it was found that the highest positive CRP value only reached a titer of 1:2 with a level of 12 IU/mL, which was found in 1 respondent (2.5%). Meanwhile, 39 other respondents (97.5%) showed negative CRP results. These findings indicate that most brick workers did not experience acute systemic inflammation at the time of examination.

The low proportion of positive CRP results can be explained by the characteristics of CRP, which is highly sensitive to acute inflammatory conditions. CRP levels will increase rapidly when inflammation occurs, but will also decrease sharply when the inflammatory process or tissue damage subsides, returning to normal values (12). Another possibility is that the inflammatory process experienced by the respondents had subsided at the time of blood sampling, either due to the consumption of anti-inflammatory drugs or due to the body's immune system regulatory mechanisms, causing CRP levels in the blood to return to normal (13).

Based on graph 1, most brick workers do not use personal protective equipment (PPE) while working and have a habit of smoking. The low use of PPE reflects a lack of awareness of occupational safety and health. According to Ramadhansyah et al., noncompliance with PPE use can increase the risk of occupational diseases, including tissue damage and inflammatory processes that can potentially increase CRP levels. Not using PPE, especially respiratory protection, makes workers more vulnerable to exposure to dust and harmful particles that can trigger respiratory disorders and inflammatory responses (14)

In addition to the use of PPE, smoking is also a dominant characteristic among brick workers. In terms of lifestyle, positive CRP results were found in respondents who smoked, both active and passive smokers. High exposure to cigarette smoke in the surrounding

environment, both at home and in social settings, can aggravate inflammation in the body (15).

However, negative CRP results were also found in some workers who smoked. This condition is likely influenced by the relatively short duration of smoking and the type of cigarettes consumed. The use of filtered cigarettes is known to reduce exposure to harmful substances such as nicotine, tar, and carbon monoxide, so that the damage to tissues or organs is not significant enough to stimulate an increase in CRP secretion (16). This finding is in line with research by Sampurna and Zulaikhah (2022), which states that CRP levels are influenced by the duration of smoking and the number of cigarettes consumed per day (17).

Based on graph 2, the characteristics of brick workers according to age and length of service show a tendency for a association between age and CRP test results. Respondents who showed positive CRP results were in the >50 age group, namely 56 years old. This indicates that age is a factor in the occurrence of systemic inflammation. Conversely, length of employment did not show a clear association with CRP test results, as respondents with positive results did not have longer employment periods than other respondents. These findings differ from those of Zahroh and Keman (2019), who reported a very strong positive association between length of service and increased CRP levels. This difference in results indicates that the effect of length of service on inflammation can vary, depending on individual conditions, work environment, and other risk factors associated with workers (18).

When viewed from the perspective of age, the results of this study are in line with various previous studies that emphasize the role of aging in the inflammatory process. Research by Tang et al. (2018) states that the aging process is closely related to an increase in chronic inflammation, where levels of proinflammatory cytokines such as IL-6, TNF- α , and CRP tend to increase with age, even in the absence of acute infection (19).



These findings are also supported by research conducted by Putri et al. (2023), which shows that CRP levels tend to increase in older age groups. In that study, CRP tests on 40-year-old smokers showed negative results, while those aged 50 and 55 showed positive results with CRP levels of 12 mg/dL, respectively. This reinforces the findings of this study that age may be a more dominant factor than length of employment in influencing CRP test results among brick workers (20). The CRP testing method used in this study is semiquantitative, so the results obtained are ordinal categories based on the highest dilution that shows agglutination reaction, not the exact numerical value of CRP levels. Semiquantitative methods have limitations in analytical validation because they do not apply accuracy and precision parameters as quantitative methods do, so their sensitivity and detection capabilities are lower. Therefore, further research using quantitative methods, such as immunoturbidimetry or high-sensitivity CRP (hs-CRP), is needed to obtain more accurate CRP level data that can be analyzed statistically (21).

CONCLUSION AND RECOMMENDATIONS

This study concluded that the majority of workers in the traditional brick industry in Banyumas Regency did not show signs of acute systemic inflammation based on C-Reactive Protein (CRP) level measurements, even though they were involved in activities in an environment with high exposure to dust, minimal use of personal protective equipment, and a significant prevalence of smoking. These findings indicate that occupational exposure and daily activity patterns in most research subjects have not reached the threshold to trigger a detectable acute inflammatory response, while increased CRP levels with low titers in older workers confirm the role of age and lifestyle as factors that increase susceptibility to the inflammatory process. Therefore, it is recommended to improve occupational safety and health education, compliance with the use of personal protective equipment, control of



smoking habits, regular health monitoring, and the development of further research with more sensitive inflammatory examination methods to support efforts to prevent occupational diseases.

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