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C-Reactive Protein Levels among Obese Students at John Paul II Health Academy Pekanbaru: A Cross-Sectional Study

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ABSTRACT

Obesity is associated with chronic low-grade inflammation characterized by increased secretion of pro-inflammatory cytokines from adipose tissue, which may stimulate hepatic synthesis of C-Reactive Protein (CRP). Elevated CRP levels are widely recognized as biomarkers of systemic inflammation and may indicate increased risk for metabolic and cardiovascular disorders. This study aimed to evaluate CRP levels among obese students at Akademi Kesehatan John Paul II Pekanbaru. This study employed a descriptive cross-sectional design involving obese students with Body Mass Index (BMI) ≥27 kg/m² selected using purposive sampling. Serum samples were collected and analyzed for CRP levels using qualitative latex agglutination and semi-quantitative methods. A total of 19 serum samples met the inclusion criteria and were included in the analysis. The results showed that 12 respondents (63.2%) had normal CRP levels (<6 mg/L), while 7 respondents (36.8%) demonstrated elevated CRP levels. Among the positive samples, 5 respondents had CRP levels of 12 mg/L and 2 respondents had CRP levels of 24 mg/L. These findings indicate that obesity does not always correlate with elevated CRP levels, suggesting that additional factors such as dietary habits, physical activity, and lifestyle may influence systemic inflammatory status in obese individuals. Continuous monitoring of inflammatory biomarkers and lifestyle modification remain important in preventing obesity-related complications.

Keywords: *C-Reactive Protein, Obesity, Inflammation, Students, Body Mass Index*

ABSTRAK

Obesitas berkaitan dengan inflamasi sistemik derajat rendah kronis yang ditandai dengan peningkatan sekresi sitokin proinflamasi dari jaringan adiposa, sehingga dapat merangsang sintesis C-Reactive Protein (CRP) di hati. Peningkatan kadar CRP dikenal sebagai biomarker inflamasi sistemik yang dapat mengindikasikan peningkatan risiko gangguan metabolik dan kardiovaskular. Penelitian ini bertujuan untuk mengevaluasi kadar CRP pada mahasiswa obesitas di Akademi Kesehatan John Paul II Pekanbaru. Penelitian ini menggunakan desain deskriptif dengan pendekatan cross-sectional yang melibatkan mahasiswa obesitas dengan Indeks Massa Tubuh (IMT) ≥27 kg/m² menggunakan teknik purposive sampling. Sampel serum diperiksa menggunakan metode latex agglutination secara kualitatif dan semi-kuantitatif. Sebanyak 19 sampel serum memenuhi kriteria inklusi dan dianalisis dalam penelitian ini. Hasil penelitian menunjukkan bahwa 12 responden (63,2%) memiliki kadar CRP normal (<6 mg/L), sedangkan 7 responden (36,8%) menunjukkan peningkatan kadar CRP. Dari sampel yang positif, sebanyak 5 responden memiliki kadar CRP sebesar 12 mg/L dan 2 responden sebesar 24 mg/L. Temuan ini menunjukkan bahwa obesitas tidak selalu berkorelasi dengan peningkatan kadar CRP, sehingga faktor lain seperti pola makan, aktivitas fisik, dan gaya hidup kemungkinan turut memengaruhi status inflamasi sistemik pada individu obesitas. Pemantauan biomarker inflamasi dan modifikasi gaya hidup tetap penting dilakukan untuk mencegah komplikasi terkait obesitas.

Kata kunci: C-Reactive Protein, Obesitas, Inflamasi, Mahasiswa, Indeks Massa Tubuh

INTRODUCTION

Obesity is a global public health problem characterized by excessive accumulation of body fat resulting from an imbalance between energy intake and expenditure. The prevalence of obesity continues to increase worldwide and has become a major contributor to non-communicable diseases, including cardiovascular disease, diabetes mellitus, hypertension, and metabolic syndrome(1). According to the World Health Organization (WHO), more than one billion adults worldwide are classified as overweight, and at least 300 million individuals are categorized as obese. In several developed countries, such as the United States and Western Europe, obesity affects nearly two-thirds of the population, while in Indonesia the prevalence of obesity continues to increase significantly each year(2). In Pekanbaru City, obesity remains a growing health concern, with approximately 36.35% of the population reported to experience obesity-related conditions(3).

Obesity is closely associated with chronic low-grade systemic inflammation. Excessive adipose tissue accumulation stimulates adipocytes to secrete pro-inflammatory cytokines such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and monocyte chemoattractant protein-1 (MCP-1). Increased IL-6 secretion subsequently stimulates hepatic synthesis of C-Reactive Protein (CRP), an acute-phase protein widely used as a biomarker of systemic inflammation (4). Elevated CRP levels have been associated with increased risk of cardiovascular disorders, insulin resistance, endothelial dysfunction, and metabolic complications among obese individuals (5). Normal CRP levels are generally reported to be below 6 mg/L, whereas elevated concentrations may indicate inflammatory activity within the body(4).

Several previous studies have demonstrated a positive association between obesity and increased CRP levels. Bhadra et al. reported that among 82 obese adults aged 40–48 years, approximately 43.9% demonstrated elevated CRP concentrations, while only a small proportion had normal CRP levels(5). Similarly, Mahwati and Nurrika identified elevated CRP levels in 58.4% of obese Indonesian adults aged above 40 years(6). These findings support the hypothesis that obesity contributes to systemic inflammatory responses through adipose tissue dysregulation.

However, previous studies mainly focused on adult and middle-aged populations, whereas studies evaluating CRP levels among obese young adults and students remain limited.

Interestingly, not all obese individuals exhibit elevated CRP levels. Several studies suggest that lifestyle factors such as regular physical activity, healthy dietary habits, adequate sleep, and metabolic adaptation may influence inflammatory status despite increased body mass index(4). Therefore, obesity may not always directly correlate with elevated inflammatory biomarkers. This condition indicates that inflammatory responses in obesity are multifactorial and may vary depending on lifestyle characteristics and metabolic conditions of each individual.

The novelty of this study lies in the evaluation of C-Reactive Protein levels specifically among obese students in a health sciences academic environment, a population that has received limited attention in previous inflammatory biomarker studies. In addition, this study combines qualitative and semi-quantitative CRP examination methods to provide a broader overview of inflammatory status among obese students. Understanding CRP profiles in young obese populations is important because chronic low-grade inflammation may begin early and potentially increase the risk of future metabolic and cardiovascular diseases.

Based on these considerations, this study aimed to determine the profile of C-Reactive Protein levels among obese students at Akademi Kesehatan John Paul II Pekanbaru. The findings of this study are expected to provide scientific information regarding inflammatory status in obese young adults and contribute to preventive strategies through lifestyle modification and early metabolic risk monitoring.

METHODS

This study employed a descriptive observational design with a cross-sectional approach to evaluate C-Reactive Protein (CRP) levels among obese students at Akademi Kesehatan John Paul II Pekanbaru. The study was conducted at the Hematology Laboratory of Akademi Kesehatan John Paul II Pekanbaru. The study population consisted of students enrolled at Akademi Kesehatan John Paul II Pekanbaru who met the obesity criteria based on Body Mass Index (BMI). Samples were selected using purposive sampling according to predetermined inclusion criteria, including students with BMI $\geq$27 kg/m² categorized as obese, respondents willing to participate in the study, and respondents who signed informed consent forms prior to sample collection. A total of 19 respondents fulfilled the inclusion criteria and were included in the study. Venous blood samples were collected from each respondent under standardized phlebotomy procedures. Blood specimens were centrifuged to obtain serum samples for laboratory examination. CRP level analysis was performed using qualitative and semi-quantitative latex agglutination methods. In the qualitative method, the presence of visible agglutination indicated positive CRP reactivity. Samples showing positive qualitative results were subsequently analyzed using semi-quantitative testing through serial dilution methods to determine CRP concentration levels.

The variables observed in this study included Body Mass Index (BMI) as the independent variable and serum C-Reactive Protein (CRP) levels as the dependent variable. Data obtained from laboratory examinations were analyzed descriptively and presented in the form of frequency distributions, percentages, tables, and narrative explanations to describe the profile of CRP levels among obese students. This study was conducted following ethical principles in biomedical research, including confidentiality, voluntary participation, and informed consent from all respondents prior to blood sample collection.

RESULTS

Body Mass Index (BMI) measurements conducted among students at Akademi Kesehatan John Paul II Pekanbaru identified 19 respondents who met the obesity criteria with BMI ≥27 kg/m². Blood samples were collected from all eligible respondents who had signed informed consent forms prior to specimen collection. Serum samples were subsequently analyzed for C-Reactive Protein (CRP) levels using qualitative and semi-quantitative latex agglutination methods. Qualitative CRP examination demonstrated that 12 respondents (63.2%) had negative CRP results, indicating normal CRP concentrations below 6 mg/L. Meanwhile, 7 respondents (36.8%) demonstrated positive agglutination reactions, indicating elevated CRP levels. Positive samples were further analyzed using semi-quantitative methods to determine CRP concentrations.

Table 1. Semi-quantitative CRP Examination Results among Obese Students

Dilution	CRP Levels (mg/L)	Frequency (n)
1/2	12	5
1/4	24	2
1/8	48	0
1/16	96	0
1/32	192	0
Total		7

Semi-quantitative analysis showed that 5 respondents (26.3%) had CRP concentrations of 12 mg/L, while 2 respondents (10.5%) demonstrated CRP concentrations of 24 mg/L. No respondents demonstrated CRP levels above 24 mg/L. These findings indicate that although obesity is commonly associated with systemic inflammation, the majority of obese students in this study maintained normal CRP levels. The distribution of CRP levels among obese students is illustrated in Figure 1.

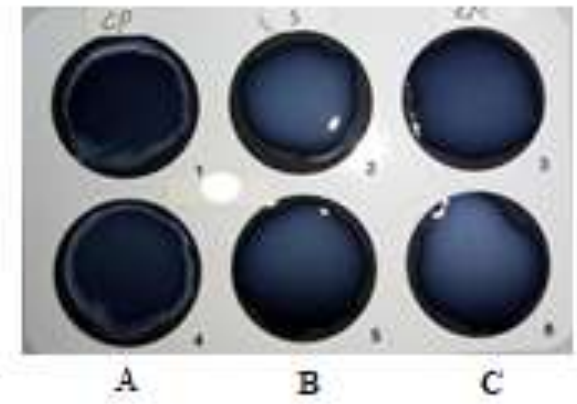

Figure 1. Distribution of CRP Levels among Obese Students

The findings suggest that elevated inflammatory responses were only observed in a proportion of respondents despite all participants being categorized as obese based on BMI measurements. Most respondents demonstrated normal inflammatory status, indicating possible influences from lifestyle factors, nutritional habits, physical activity, and metabolic adaptation.

DISCUSSION

This study evaluated C-Reactive Protein (CRP) levels among obese students at Akademi Kesehatan John Paul II Pekanbaru to identify the inflammatory profile associated with obesity in young adults. The findings demonstrated that most respondents (63.2%) had normal CRP levels (<6 mg/L), while only 36.8% showed elevated CRP concentrations ranging from 12 mg/L to 24 mg/L. These results indicate that obesity does not always directly correlate with increased systemic inflammation as reflected by elevated CRP levels. Physiologically, obesity is characterized by excessive accumulation of adipose tissue resulting from energy imbalance and triglyceride storage. Adipose tissue is recognized not only as an energy storage organ but also as an active endocrine organ capable of secreting various pro-inflammatory cytokines, including interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and monocyte chemoattractant protein-1 (MCP-1). Increased IL-6 secretion stimulates hepatic synthesis of C-Reactive Protein, which subsequently serves as a biomarker of systemic inflammation(7–9). Therefore, obese individuals are generally expected to demonstrate elevated CRP concentrations due to chronic low-grade inflammatory processes. However, the findings of this study demonstrated that most obese respondents maintained normal CRP levels. These results suggest that inflammatory responses in obesity are multifactorial and may not solely depend on Body Mass Index (BMI). Lifestyle factors such as healthy dietary patterns, regular physical activity, adequate sleep, and metabolic adaptation may contribute to maintaining normal inflammatory status despite increased adiposity. Previous studies have reported that obese individuals with healthier lifestyles tend to demonstrate lower inflammatory biomarker levels compared to obese individuals with poor lifestyle habits(10,11).

The present findings are consistent with previous research conducted by Reza (2023), which reported that among 15 obese respondents, only one individual demonstrated elevated CRP levels. Similar studies also suggest that obesity-related inflammation may vary depending on metabolic health status, dietary intake, and physical activity levels(11,12). According to Azizah and Sulchan, excessive fast-food consumption, low intake of fruits and vegetables, smoking, and sedentary lifestyle are important contributors to increased inflammatory activity among obese individuals(13,14). Therefore, obesity should not be interpreted solely based on anthropometric measurements but should also consider metabolic and inflammatory profiles.

Among respondents with elevated CRP levels, most demonstrated concentrations of 12 mg/L, while only two respondents showed CRP levels of 24 mg/L. Elevated CRP concentrations may indicate the presence of low-grade chronic inflammation associated with adipose tissue expansion. Persistent inflammatory responses in obese individuals may increase the risk of insulin resistance, endothelial dysfunction, atherosclerosis, and cardiovascular disease development in later life(5,15). Although the CRP elevations observed in this study were relatively mild, continuous inflammatory stimulation may contribute to long-term metabolic complications if not properly managed.

An important finding in this study is that no respondents demonstrated extremely high CRP concentrations (>48 mg/L), which are generally associated with acute infection, severe inflammation, or trauma. This indicates that the inflammatory responses identified among respondents were more likely related to chronic low-grade inflammation associated with obesity rather than acute pathological conditions. These findings reinforce the concept that obesity-related inflammation develops gradually and may remain clinically asymptomatic during early stages(16,17).

The novelty of this study lies in the evaluation of inflammatory status among obese students within a health sciences educational environment, a population that remains underrepresented in obesity-related biomarker studies. Previous studies have predominantly focused on adult or elderly obese populations with metabolic disorders, whereas this study specifically investigated young obese adults who may still demonstrate relatively good metabolic adaptation. In addition, this study combined qualitative and semi-quantitative CRP examination methods to provide a more comprehensive overview of inflammatory profiles among obese students.

The findings of this study emphasize the importance of early lifestyle intervention among obese young adults to prevent progression toward chronic metabolic and cardiovascular diseases. Routine monitoring of inflammatory biomarkers such as CRP may contribute to early detection of obesity-related inflammation even before clinical manifestations appear. Nutritional counseling, increased physical activity, weight management, and healthy lifestyle modification should therefore be promoted among young obese populations as preventive strategies against future metabolic complications.

CONCLUSIONS

This study demonstrated that obesity was not consistently associated with elevated C-Reactive Protein (CRP) levels among students at Akademi Kesehatan John Paul II Pekanbaru. Most obese respondents exhibited CRP concentrations within the normal range, indicating that increased body mass index alone may not necessarily reflect the presence of systemic inflammation. The findings suggest that inflammatory status in obese individuals is influenced by multiple factors beyond adiposity, including lifestyle behaviors, dietary patterns, physical activity, and overall metabolic health.

The presence of elevated CRP levels in a subset of respondents indicates that some obese individuals may experience low-grade chronic inflammation, which could increase the risk of future metabolic and cardiovascular complications. Therefore, assessment of inflammatory biomarkers may provide additional information beyond anthropometric measurements in evaluating obesity-related health risks. Future studies are recommended to include larger sample sizes and incorporate additional inflammatory biomarkers, such as high-sensitivity C-reactive protein (hs-CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α), to better understand the relationship between obesity and systemic inflammation. Furthermore, evaluation of dietary habits, physical activity levels, and metabolic parameters is necessary to identify factors contributing to inflammatory responses among obese young adults..

REFERENCES

1. Ahmed SK, Mohammed RA. Obesity: Prevalence, causes, consequences, management, preventive strategies and future research directions. Metab open. 2025 Sep;27:100375.

2. WHO. WHO Indonesia. 2026 [cited 2025 Nov 4]. Indonesia develops new regulations to tackle unhealthy food consumption. Available from: https://www.who.int/indonesia/news/detail/27-01-2026-indonesia-develops-new-regulations-to-tackle-unhealthy-food-consumption

3. Survei Kesehatan Indonesia. Survei Kesehatan Indonesia dalam Angka. Badan Kebijakan Pembangunan Kesehatan. 2023. 1–68 p.

4. Ellulu MS, Patimah I, Khaza'ai H, Rahmat A, Abed Y. Obesity and inflammation: the linking mechanism and the complications. Arch Med Sci. 2017 Jun;13(4):851–63.

5. Shukla N, Singh S, Singh S, Shukla A. Association of High-sensitivity C-reactive Protein Level with Obese Normal individuals in North Indian Population. Ann Afr Med. 2025 Jan;24(1):45–50.

6. Yeni Mahwati DN. Obesity Indicators and C-Reactive Protein in Indonesian Adults (More than Equal to 40 Years Old): The Indonesian Family Life Obesity Indicators and C-Reactive Protein in Indonesian Adults (More than Equal to 40 Years Old): The Indonesian Family Life S. Kesmas. 2020;15(4):169–74.

7. Bhoi S, Das K, Meher P, Panda B, Acharya M, Barik D, et al. Serum High-sensitive C-

Reactive Protein, Interleukin-6 and Malondialdehyde Levels in Acne Vulgaris and Their Correlation With Disease Severity: A Cross-Sectional Study. Cureus. 2025 Jul;17(7):e88405.

8. Su JH, Luo MY, Liang N, Gong SX, Chen W, Huang WQ, et al. Interleukin-6: A Novel Target for Cardio-Cerebrovascular Diseases. Front Pharmacol. 2021;12:745061.

9. Peña-Durán E, García-Galindo JJ, López-Murillo LD, Huerta-Huerta A, Balleza-Alejandri LR, Beltrán-Ramírez A, et al. Microbiota and Inflammatory Markers: A Review of Their Interplay, Clinical Implications, and Metabolic Disorders. Int J Mol Sci [Internet]. 2025;26(4). Available from: https://www.mdpi.com/1422-0067/26/4/1773

10. Li Q, Wang Q, Xu W, Ma Y, Wang Q, Eatman D, et al. C-Reactive Protein Causes Adult-Onset Obesity Through Chronic Inflammatory Mechanism. Front cell Dev Biol. 2020;8:18.

11. Issabella Nisrina Pratiwi, Ninik Mudjihartini WIW. The Relationship Between Vitamin D Intake And Plasma C-Reactive Protein Levels And Appendicular Skeletal Muscle Index In Adults With Obesity. Sosioedukasi. 2026;15(1):719–32.

12. Megawati G, Indraswari N, Johansyah AA, Kezia C, Herawati DMD, Gurnida DA, et al. Comparison of hs-CRP in Adult Obesity and Central Obesity in Indonesia Based on Omega-3 Fatty Acids Intake: Indonesian Family Life Survey 5 (IFLS 5) Study. Int J Environ Res Public Health. 2023 Sep;20(18).

13. Khalfan SS, Minani J, Muki SK, Said FA, Lyakurwa DM, Zhang B. Impact of Fast Food Consumption on Obesity and Overweight among Individuals Aged Ten Years and Above: A Systematic Review and Meta-Analysis. Iran J Public Health. 2025 Sep;54(9):1808–19.

14. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Lifestyle factors associated with overweight and obesity among Saudi adolescents. BMC Public Health. 2012 May;12:354.

15. Kamińska MS, Lubkowska A, Panczyk M, Walaszek I, Grochans S, Grochans E, et al. Relationships of Body Mass Index, Relative Fat Mass Index, and Waist Circumference with Serum Concentrations of Parameters of Chronic Inflammation. Nutrients [Internet]. 2023;15(12). Available from: https://www.mdpi.com/2072-6643/15/12/2789

16. Orsolini L, Pompili S, Tempia Valenta S, Salvi V, Volpe U. C-Reactive Protein as a Biomarker for Major Depressive Disorder? Int J Mol Sci. 2022 Jan;23(3).

17. Mouliou DS. C-Reactive Protein: Pathophysiology, Diagnosis, False Test Results and a Novel Diagnostic Algorithm for Clinicians. Diseases [Internet]. 2023;11(4). Available from: https://www.mdpi.com/2079-9721/11/4/132