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CORRELATION OF HS-CRP LEVELS AND TOTAL PROTEIN IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT DR. BRATANATA HOSPITAL JAMBI CITY

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ABSTRACT

Background: *Type 2 Diabetes Mellitus (DM) is a chronic disease characterized by hyperglycemia and mild systemic inflammation. High-sensitivity C-Reactive Protein (hs-CRP) is an inflammatory marker elevated in type 2 DM, while total protein levels reflect the nutritional and inflammatory status of the body. The correlation between hs-CRP and total protein may provide insight into the inflammatory and metabolic status of type 2 DM patients.*
Methods: *This descriptive-analytic study used a cross-sectional design and was conducted at Dr. Bratanata Hospital, Jambi City. The sample consisted of T2DM patients selected through purposive sampling based on inclusion and exclusion criteria. hs-CRP levels were measured using a Wondfo Meter, and total protein was analyzed using an Autolyser BT 3500. Statistical tests were conducted to determine the relationship between the variables.*
Results: *The average hs-CRP level was 4.25 mg/L and the total protein level was 7.40 g/dL. A weak negative correlation was found between hs-CRP and total protein levels, which was statistically significant (p = 0.023).*
Conclusion: *There is a significant correlation between hs-CRP and total protein levels in type 2 DM patients. Increased hs-CRP tends to be followed by a decrease in total protein levels, although the correlation is weak. Measurement of hs-CRP and total protein can serve as early indicators of inflammatory and metabolic status in type 2 DM patients.*

Keywords: *Diabetes Mellitus; Total Protein; hs-CRP; Inflammation*

INTRODUCTION

Diabetes Mellitus (DM) is a non-communicable disease and a leading cause of death globally. It results from metabolic disorders in the pancreas, leading to hyperglycemia due to reduced insulin production, and can cause both macrovascular and microvascular complications (Saputri, 2016).

Indonesia ranks fourth in the world for the highest number of DM cases, after the U.S., China, and India (Muliani, 2015). The WHO estimates an increase from 8.4 million cases in 2000 to 21.3 million by 2030. About 90–95% of cases are type 2 DM (Saeedi et al., 2019). The IDF reported that in 2017, Indonesia ranked sixth with 10.2 million people aged 20–79 living with DM (Andamari et al., n.d.). In 2019, DM caused 1.5 million deaths, 48% of which occurred before age 70 (Global Burden of Disease Study, 2019).

In Jambi Province, the number of DM cases reached 45,781 in 2022, with 21,127 recorded at 20 public health centers and 1,010 outpatients diagnosed at Dr. Bratanata Hospital

in Jambi City in 2024 (Jambi Provincial Health Office, 2022). Hyperglycemia triggers chronic inflammation, which can be measured through leukocyte count. Pro-inflammatory cytokines such as IL-6 and IL-8 increase in DM patients and stimulate leukocyte, especially neutrophil, production (Farhangi et al., 2013; Yanti et al., 2017).

C-Reactive Protein (CRP) is an acute-phase protein that rises in response to inflammation and may increase several-fold in type 2 DM. Normal levels are <6 mg/L and can rise within 4–6 hours after tissue injury (Wibowo et al., 2018). CRP screening can help detect early complications such as diabetic kidney damage (Amelia et al., 2020). Insulin resistance affects carbohydrate, lipid, and protein metabolism. Proteins, including albumin (60%) and globulin (40%), are essential for bodily functions (Almatsier, 2014; The Journal of Clinical Investigation, 51). In DM, hyperglycemia increases protein and fat catabolism and alters plasma protein levels. Inflammation also induces acute-phase protein production.

CRP reflects systemic inflammation in DM and is associated with poor glycemic control and risks of complications like cardiovascular disease and nephropathy (Ridker et al., 2016). Changes in total protein, albumin, and globulin levels reflect patients' clinical and inflammatory status (Powers et al., 2022).

Studies on the relationship between CRP and total protein show varied results. Rachma et al. (2023) found no significant difference in total protein between controlled and uncontrolled DM, while Febrianto et al. (2021) reported a positive correlation between CRP levels and albuminuria in type 2 DM patients.

METHODS

This study is a descriptive-analytic research utilizing a cross-sectional design. It aims to investigate the relationship between high-sensitivity C-reactive protein (hs-CRP) levels and total protein in individuals with type 2 diabetes mellitus. The study population and sample consisted of patients diagnosed with type 2 diabetes mellitus, with data collection from 40 respondents and analysis conducted at Dr. Bratanata Hospital between November 30 and December 7, 2024. The instruments used in this study included Wondfo meter for analyzing hs-CRP levels and Autolyser BT 3500 for measuring protein levels.

Primary data were collected through purposive sampling, which applied specific inclusion and exclusion criteria.

Inclusion criteria included:

1. Patients who were willing to participate as respondents and had signed an informed consent form.
2. Patients who had been clinically diagnosed with type 2 diabetes mellitus, as confirmed by their medical records.

Exclusion criteria included:

1. Pregnant women.
2. Patients with diabetes mellitus who had known complications such as tuberculosis, HIV, anemia, and others.

The research of this study has obtained an ethical approval from the Ethics Committee at the Jambi Ministry of Health Poltekkes.

RESULTS AND DISCUSSION

3.1 Respondent Characteristics

Based on the processed data, the distribution of hs-CRP and total protein according to respondent characteristics is illustrated in the graphs and tables below:

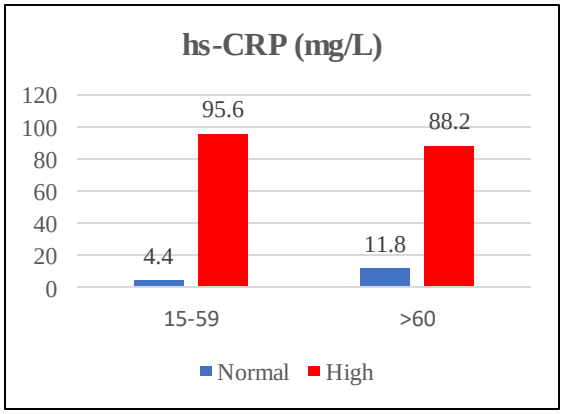

Figure 1. Distribution Based on Age

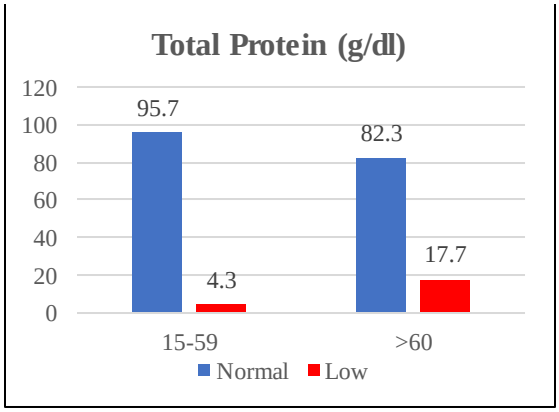

Figure 2. Distribution Based on Age

Tabel 1. Results of Examination Based on Age

HsCRP	N	Mean	Min	Max	SD	P-value
19 - 59	23	4.3	0.9	5.1	1.08	0.319
>60	17	4.1	0.5	5.1	1.44	
Total	40	4.2	0.5	5.1	1.26	
Total Protein						
19 - 59	23	7,3	6,2	8,5	0,5	0,270
>60	17	7,4	6,2	8,3	0,7	
Total	40	7,35	6,2	8,5	0,6	

The distribution of hs-CRP and total protein by age. The hs-CRP boxplot shows a similar distribution among groups, with an average of 4.3 mg/L for the 19–59 age group and 4.1 mg/L for those over 60 years old (p = 0.319), indicating no significant difference between age groups. Conversely, the total protein boxplot shows a higher median in the over-60 group. The average total protein was 7.3 g/dL in the 19–59 age group and 7.4 g/dL in those over 60 years, with a p-value of 0.27, also showing no significant difference.

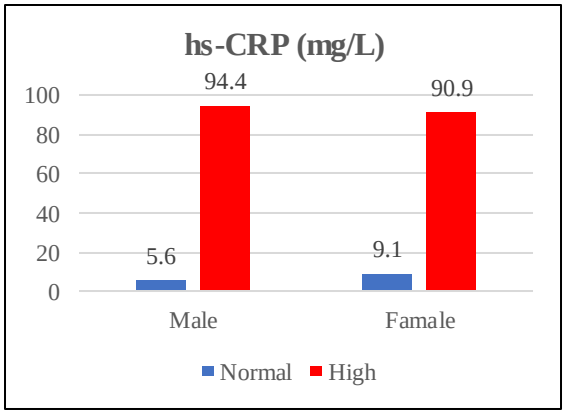

Figure 3. Distribution Based on Gender

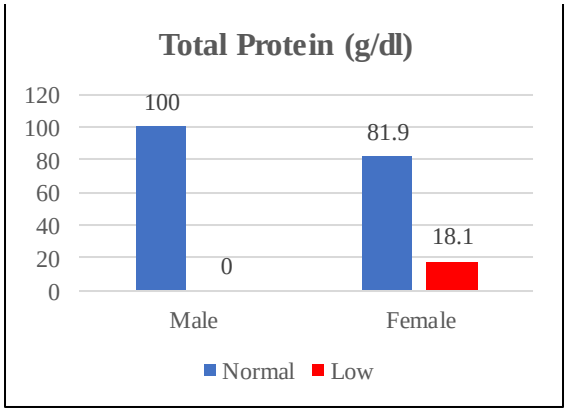

Figure 4. Distribution Based on Gender

Tabel 2. Results of Examination Based on Gender

HsCRP	N	Mean	Min	Max	SD	P-value
Male	18	4.31	0.8	5.1	1.20	0.386
Female	22	4.2	0.5	5.1	1.29	
Total	40	4.25	0.5	5.1	1.24	
Total Protein						
Male	18	222.6	137	275	39.05	0.266
Female	22	214.7	120	301	39.12	
Total	40	218.3	120	301	38.8	

The istribution of hs-CRP and total protein based on gender. The hs-CRP boxplot displays nearly identical distributions between males and females, with an average of 4.31 mg/L for males and 4.22 mg/L for females (p = 0.386), indicating no significant difference. In the total protein boxplot, females had a slightly higher median than males. The average total protein was 7.11 g/dL for males and 7.62 g/dL for females, with a p-value of 0.0004, indicating a significant difference.

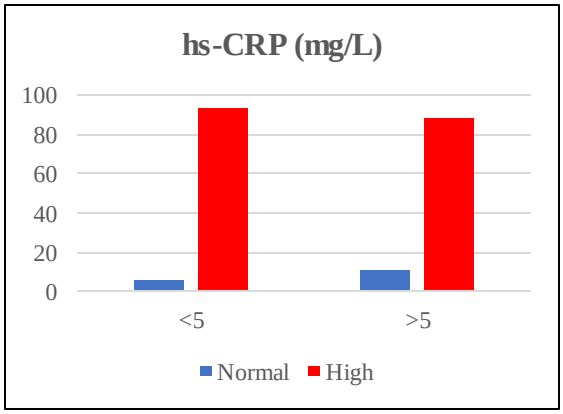

Figure 5. Distribution Based on Duration of Illness

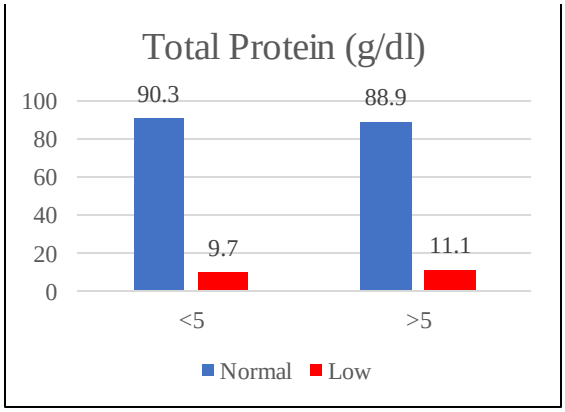

Figure 6. Distribution Based on Duration of Illness

Tabel 3. Results of Examination Based on Duration of Illness

HsCRP	N	Mean	Min	Max	SD	P-value
<5	31	4.35	0.8	5.1	1.14	0.164
>5	9	3.88	0.5	5.0	1.53	
Total	40	4.11	0.5	5.1	1.33	
Total Protein						
<5	31	7,36	6,2	8,5	0,63	0,250
>5	9	7,52	6,4	8,3	0,61	
Total	40	7,44	6,2	8,5	0,62	

The distribution of hs-CRP and total protein based on the duration of having type 2 diabetes mellitus. The average hs-CRP for patients with less than 5 years of disease duration was 4.35 mg/L, higher than the 3.88 mg/L for patients with more than 5 years of disease, though the difference was not significant ($p = 0.164$). Meanwhile, in terms of total protein, patients with more than 5 years of diabetes had a higher average of 7.52 g/dL compared to 7.36 g/dL in those with less than 5 years of disease duration. However, this difference was also not significant ($p = 0.25$).

3.2. Correlation of hs-CRP Levels and Total Protein in Patients with Type 2 Diabetes Mellitus at Dr. Bratanata Hospital Jambi City

The correlation test results are shown in the graph below. Before conducting the correlation test, the data were tested for normality using the Shapiro-Wilk test. The p-values for hs-CRP and total protein were ≤ 0.05 and < 0.05, respectively, indicating normally distributed data, thus the non-parametric Spearman Correlation test was used.

Table 4 presents the Spearman correlation results between hs-CRP and total protein levels among 40 patients with type 2 diabetes mellitus. The mean hs-CRP level was 4.25 mg/L, while the mean total protein level was 7.40 g/dl. Spearman correlation analysis revealed a weak negative correlation ($r = -0.358$) between hs-CRP and total protein, which was statistically significant ($p = 0.023$).

Table 4. Results of Correlation Spearman

Parameter	n	Mean	Median	Minimal-maximal	sd	Coefficient Correlation	P
hs-CRP	40	4.25	4.9	0.5 – 5.1	1.2	-0,358	0,023
Protein total	40	7,40		6,2 – 8,5	0,6		

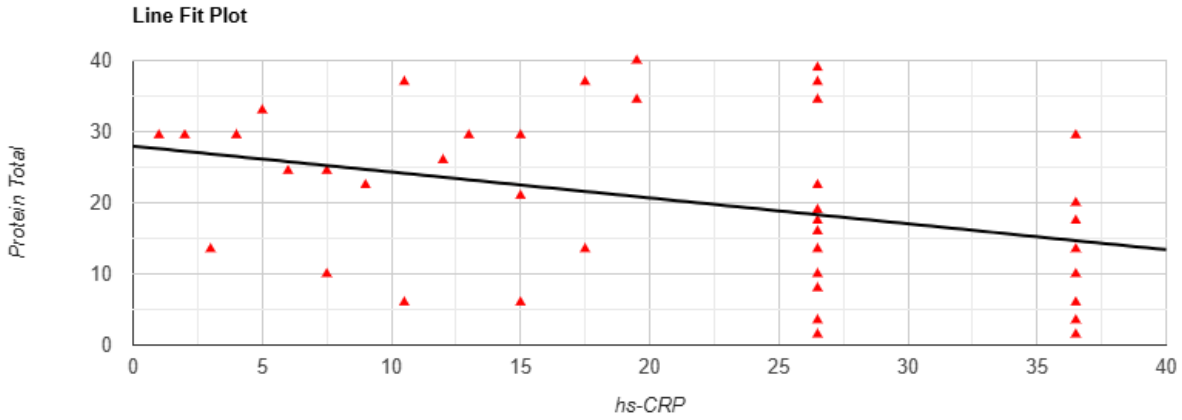

Figure 4. Results of Correlation Spearman

The analysis showed a weak negative correlation pattern between hs-CRP levels and serum total protein levels. This was illustrated by a scatter plot with a downward linear regression line (Figure 4). Although the observed correlation was negative, the wide data distribution showed that the correlation was not statistically significant nor clinically strong.

This pattern suggests that increased hs-CRP, an indicator of systemic inflammation, tends to be followed by a slight decrease in total protein levels. This aligns with physiological mechanisms where acute inflammatory responses alter liver protein synthesis. Inflammatory conditions increase the production of acute-phase proteins such as CRP while reducing the synthesis of other proteins, including albumin—a key component of total protein.

Additionally, factors such as hydration status, malnutrition, or liver and kidney dysfunction can independently affect total protein levels apart from hs-CRP levels. Thus, although a negative trend was indicated, the relationship between hs-CRP and total protein appears multifactorial and non-linear.

The analysis concluded that hs-CRP levels cannot be directly used as a predictor of total protein levels in serum. Comprehensive protein status evaluation must still consider other factors beyond systemic inflammation.

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CONCLUSION

The average hs-CRP level in type 2 DM patients at Dr. Bratanata Hospital Jambi City was 4.25 mg/L.

The average total protein level in type 2 DM patients at Dr. Bratanata Hospital Jambi City was 7.40 g/dL.

A significant correlation was found between hs-CRP and total protein levels in type 2 DM patients at Dr. Bratanata Hospital Jambi City, with a p-value of 0.023.

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CONFLICT OF INTEREST

The author declares there is no any conflict of interest during this study.

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