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Relationship of Triglyceride Levels with the Incidence of Acute Coronary Syndrome in Patients with Type 2 Diabetes Mellitus at RSPAL Dr. Ramelan Surabaya

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ABSTRACT

Type 2 Diabetes Mellitus (DM) is a major global health issue with increasing prevalence, including in Indonesia, where it significantly contributes to cardiovascular diseases such as Acute Coronary Syndrome (ACS). This study investigates the relationship between triglyceride levels and ACS occurrence in Type 2 DM patients at RSPAL Dr. Ramelan Surabaya. The objective is to explore triglyceride distribution, examine its relationship with ACS, and assess age and gender variations in ACS incidence. Using a cross-sectional observational design, secondary data from the medical records of 92 patients were analyzed. The study found that a high percentage of patients had lipid metabolism disorders, with most exhibiting normal triglyceride levels. The distribution of ACS events revealed that APTS *was most prevalent, followed by* IMA-EST. *Spearman correlation tests showed no statistically significant relationship between triglyceride levels and ACS occurrence ($p > 0.05$). However, the study indicated that other multifactorial risk factors, such as age, gender, and lifestyle factors, played a more crucial role in the incidence of ACS in Type 2 DM patients. This study suggests that while triglyceride levels alone may not serve as a significant predictor, they could be useful in conjunction with other risk factors for early detection and prevention strategies in clinical settings. Further research is needed to explore causality and develop more effective treatment protocols.*

Keywords: *Triglyceride levels; Acute coronary syndrome; Type 2 diabetes mellitus*

INTRODUCTION

Type 2 diabetes mellitus (DM) is a chronic metabolic disease whose prevalence continues to increase globally. According to data from the International Diabetes Federation (IDF), in 2024 there were approximately 589 million adults living with diabetes worldwide. This number is projected to increase further by 2050. In Indonesia, the number of diabetes sufferers in 2024 reached 20.4 million cases, with a prevalence of 11.3%, occurring in individuals estimated to be 20–79 years of age. According to data from the World Health Organization (WHO), more than 95% of individuals with diabetes have type 2 diabetes . Type 2 diabetes is also called non-insulin-dependent or adult-onset diabetes, but is now often found in children as well. In the young to middle-aged population, the prevalence of type 2 diabetes mellitus is increasing in both sexes, but is higher in men than in women (Kautzky-Willer et al., 2023).

Type 2 diabetes mellitus (DM) is one of the most common metabolic disorders worldwide, caused by a combination of two main factors: abnormal insulin secretion by pancreatic β-cells and the inability of tissues to respond to insulin, also known as insulin resistance (Galicia-Garcia et al., 2020). Insulin is a peptide hormone produced by pancreatic β-cells that functions to regulate blood glucose levels and coordinate integrated anabolic responses to nutrient or energy availability in the body (e.g., glycogen, fat, and protein synthesis). Insulin works through insulin receptors located on the plasma membrane of target cells, namely muscle cells, the liver, and adipocytes. In conditions of insulin resistance, the liver will continue to produce glucose through gluconeogenesis even though blood glucose levels are already elevated, peripheral glucose uptake by muscles also decreases, and adipose

tissue will release large amounts of free fatty acids into the circulation, which are primarily stored as triglycerides (Petersen & Shulman, 2018). The large amount of free fatty acids in circulation then enters the liver and muscles, where they are primarily stored in the form of triglycerides, causing impaired glucose and lipid metabolism, which worsens systemic insulin resistance. This condition forces the pancreas to increase insulin secretion (hyperinsulinemia) to compensate for insulin resistance (Janssen, 2021). If this continues, it can lead to pancreatic β-cell dysfunction due to overwork, resulting in decreased insulin production, leading to persistently elevated blood glucose levels, also known as persistent hyperglycemia, which is a diagnostic sign of type 2 diabetes (Dludla et al., 2023).

Risk factors for type 2 diabetes include obesity, hypertension, dyslipidemia, an unhealthy lifestyle such as a diet high in sugar and fat, lack of physical activity, and smoking, as well as organ dysfunction such as liver dysfunction. Persistent hyperglycemia can cause target organ damage by increasing the risk of vascular disease, including microvascular disease (such as diabetic retinopathy, nephropathy, and neuropathy) and macrovascular disease (such as cardiovascular disease, cerebrovascular disease, and other peripheral vascular diseases) (Lu et al., 2024).

A high triglyceride–glucose index (TyG) is independently associated with the development of various cardiovascular diseases (Babes et al., 2022). Cardiovascular diseases such as Acute Coronary Syndrome (ACS), which carry high mortality and morbidity rates of up to 70%, are linked to type 2 diabetes, as diabetes is a major risk factor for ACS (Ma et al., 2022; Sakran et al., 2022).

ACS includes ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina pectoris (UAP) (Tabowei et al., 2024). ACS refers to a condition where blood flow to the heart is acutely or suddenly reduced, leading to myocardial ischemia, which can progress to infarction (Ismaiel et al., 2025). Patients with type 2 diabetes have a two- to four-fold higher risk of developing ACS compared to individuals without diabetes (Adninta et al., 2022). The prevalence of ACS in Indonesia has reached 2 million cases and is one of the leading causes of death in adults worldwide (Anggraini et al., 2023). Cardiovascular disease mortality is higher in men, though it remains significantly elevated in women as well (Kautzky-Willer et al., 2023).

Researchers observe the occurrence of ACS in type 2 DM patients as a common clinical finding in the field of cardiology, compounded by the risk of atherosclerosis caused by dyslipidemia, in which elevated total cholesterol, LDL, and triglyceride levels contribute to atherosclerotic plaque formation—the primary factor in the pathogenesis of ACS. Therefore, the researchers are interested in conducting a study titled "The Relationship Between Triglyceride Levels and ACS Occurrence in Type 2 DM at Dr. Ramelan Hospital, Surabaya."

The objective of this study is to investigate the relationship between triglyceride levels and the incidence of Acute Coronary Syndrome (ACS) in patients with Type 2 Diabetes Mellitus (DM) at RSPAL Dr. Ramelan Surabaya. This study also aims to determine the distribution of triglyceride levels (normal, high, and very high) in Type 2 DM patients with ACS. Additionally, this research will analyze the age and gender variations in the incidence of ACS among patients with different triglyceride levels. The study aims to evaluate the role of triglyceride levels as a potential biomarker for predicting the risk of ACS in Type 2 DM patients.

The benefits of this research are to provide scientific contributions to understanding the relationship between lipid metabolism disorders, particularly triglyceride levels, and the occurrence of ACS in Type 2 DM patients. The findings of this study can provide important clinical implications, as identifying triglyceride levels as a potential predictor will enable healthcare professionals to improve early detection and prevention strategies for ACS in Type 2 DM patients, especially in military hospitals such as RSPAL Dr. Ramelan. Furthermore, the results may provide insights for healthcare policymakers to formulate better policies related to managing Type 2 DM patients and their cardiovascular risk factors in Indonesia. This study also opens opportunities for further research, such as longitudinal studies and clinical trials, to explore causality and develop more effective treatment strategies.

METHOD

This study was an observational analytical study with a cross-sectional research design to determine the relationship between triglyceride levels and the incidence of Acute Coronary Syndrome (ACS) in type 2 DM patients at RSPAL Dr. Ramelan Surabaya for the period of January 2023 to August 2025. This study used secondary data in the form of medical records, with the study variables being all type 2 DM patients seen at the Cardiac Polyclinic for the period of January 2023 to August 2025. Patients who met the inclusion and exclusion criteria were collected, amounting to 92 patients according to the predetermined sample formula.

The study population consisted of all type 2 DM patients with ACS who were hospitalized in the Cardiac Polyclinic at RSPAL Dr. Ramelan Surabaya for the period of January 2023 to August 2025. The sample consisted of patients who experienced type 2 DM with ACS and were selected based on the following criteria:

Inclusion criteria:

1) Type 2 DM patients with ACS.
2) Available data on lipid triglyceride levels.

Exclusion criteria:

1) Patients with incomplete medical data.
2) Patients with a history of chronic kidney disease, liver cirrhosis, or cancer.

The sampling technique used in this study was purposive sampling, in which patients with type 2 DM with ACS who were hospitalized at RSPAL Dr. Ramelan Surabaya for the period of January 2023 to August 2025 were selected based on the predetermined inclusion criteria.

ACS occurrences were classified as UAP, NSTEMI, and STEMI (Shahjehan et al., 2024). Triglyceride levels, as the independent variable, were divided into four categories: normal (<150 mg/dL), borderline high (150–199 mg/dL), high (200–499 mg/dL), and very high (≥500 mg/dL) (Pappan et al., 2024).

The researcher submitted a letter of application for a research permit to the Dean of the Faculty of Medicine, Hang Tuah University Surabaya, through the Administration section. Permission was sought from the Research and Training Division of RSPAL Dr. Ramelan Surabaya to conduct an ethical feasibility review prior to commencing the study.

Data were retrieved from patient medical records at the Cardiac Polyclinic of RSPAL Dr. Ramelan Surabaya. The data were entered into statistical software. The data were subsequently

analyzed. The completeness of secondary data from patient medical records was reviewed and checked for research purposes.

Each variable was assigned a code as follows:

1) Triglyceride levels were coded 1 if normal (<150 mg/dL), coded 2 if borderline high (150–199 mg/dL), coded 3 if high (200–499 mg/dL), and coded 4 if very high (≥500 mg/dL).
2) UAP was coded 1, NSTEMI was coded 2, and STEMI was coded 3.

The categorized and grouped data were entered into the Statistical Package for the Social Sciences (SPSS) for processing. The processed data were double-checked for errors and corrected accordingly.

This study was analyzed in two stages using the Statistical Package for the Social Sciences (SPSS). Univariate analysis was used to describe the distribution and basic characteristics of each research variable, including frequencies, percentages, means, ranges, and standard deviations (Zhang, 2016). The univariate analysis included triglyceride levels across four categories (normal, borderline high, high, and very high), ACS incidence (UAP, NSTEMI, and STEMI), as well as age and sex, which were presented in a frequency distribution table.

Bivariate analysis was conducted to assess the relationship between triglyceride levels and the incidence of ACS in patients with type 2 DM at RSPAL Dr. Ramelan Surabaya (Zhang, 2016). The Spearman correlation test was used as the statistical test and the results were presented in a cross-tabulation table.

RESULTS AND DISCUSSION

Triglyceride Distribution in Type 2 DM Patients With SKA at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya

Table 1. Distribution of patients by triglyceride level category

Up to Triglyceride	Number of SKA Patients (n)	Percentage (%)
Normal (<150 mg/dL)	45	48,9
Highest Normal Limit (150–199 mg/dL)	22	23,9
High (200–499 mg/dL)	23	25
Very high (>499 mg/dL)	2	2,2
Total	92	100

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025

Based on table 1, univariate analysis shows that most of the patients with Type 2 DM with SKA have normal triglyceride levels, which is as many as 45 patients (48.9%). However, almost half of the other patients had triglyceride levels above normal, namely the highest, highest, and very high normal limits, as many as 47 patients (51.1%), indicating a high

proportion of lipid metabolism disorders in Type 2 DM patients with SKA at RSPAL dr. Ramelan Surabaya for the period January 2023-August 2025.

Table 2. Distribution of patients by incidence of SKA

SKA Incident	Number of SKA Patients (n)	Percentage (%)
APTS	38	41,3
IMA-NEST	18	19,6
IMA-EST	36	39,1
Total	92	100

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025.

Based on table 2 of the univariate analysis, it shows that the type of SKA incidence that most occurs in Type 2 DM patients at the Heart Polyclinic RSPAL dr. Ramelan Surabaya for the period January 2023-August 2025 is APTS with 38 patients (41.3%), followed by IMA-EST with 36 patients (39.1%) and IMA-NEST with the lowest proportion of 18 patients (19.6%).

Table 3. Distribution of patients by age

	SKA Incident			
Patient Age	**APTS n (%)**	**IMA-NEST n (%)**	**IMA-EST n (%)**	**TOTAL**
35	0 (0,0)	0 (0,0)	1 (100,0)	1
36	1 (100,0)	0 (0,0)	0 (0,0)	1
40	1 (100,0)	0 (0,0)	0 (0,0)	1
42	1 (100,0)	0 (0,0)	0 (0,0)	1
45	2 (66,7)	0 (0,0)	1 (33,3)	3
46	0 (0,0)	1 (50,0)	1 (50,0)	2
47	1 (50,0)	0 (0,0)	1 (50,0)	2
48	0 (0,0)	1 (50,0)	1 (50,0)	2
49	1 (50,0)	0 (0,0)	1 (50,0)	2
50	1 (100,0)	0 (0,0)	0 (0,0)	1
51	4 (50,0)	2 (25,0)	2 (25,0)	8
52	3 (75,0)	0 (0,0)	1 (25,0)	4
53	1 (20,0)	2 (40,0)	2 (40,0)	5
54	2 (40,0)	0 (0,0)	3 (60,0)	5

	SKA Incident			
Patient Age	**APTS n (%)**	**IMA-NEST n (%)**	**IMA-EST n (%)**	**TOTAL**
55	1 (50,0)	1 (50,0)	0 (0,0)	2
56	2 (28,6)	0 (0,0)	5 (71,4)	7
57	0 (0,0)	0 (0,0)	1 (100,0)	1
58	3 (100,0)	0 (0,0)	0 (0,0)	3
59	2 (50,0)	2 (50,0)	0 (0,0)	4
60	0 (0,0)	1 (25,0)	3 (75,0)	4
61	1 (50,0)	1 (50,0)	0 (0,0)	2
62	2 (50,0)	1 (25,0)	1 (25,0)	4
63	1 (25,0)	1 (25,0)	2 (50,0)	4
64	1 (33,3)	1 (33,3)	1 (33,3)	3
65	0 (0,0)	0 (0,0)	2 (100,0)	2
67	2 (50,0)	1 (25,0)	1 (25,0)	4
69	0 (0,0)	0 (0,0)	1 (100,0)	1
70	0 (0,0)	0 (0,0)	1 (100,0)	1
71	0 (0,0)	1 (50,0)	1 (50,0)	2
72	1 (100,0)	0 (0,0)	0 (0,0)	1
74	1 (50,0)	0 (0,0)	1 (50,0)	2
77	1 (50,0)	1 (50,0)	0 (0,0)	2
78	1 (100,0)	0 (0,0)	0 (0,0)	1
80	1 (100,0)	0 (0,0)	0 (0,0)	1
81	0 (0,0)	1 (100,0)	0 (0,0)	1
83	0 (0,0)	0 (0,0)	1 (100,0)	1
85	1 (100,0)	0 (0,0)	0 (0,0)	1
Total	**38**	**18**	**36**	**92**

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025.

Based on table 3, univariate analysis shows that the age distribution of Type 2 DM patients with SKA shows wide age variation in each incidence of SCA. Type 2 DM patients with APTS were most commonly found in the age range of 51 years, while Type 2 DM patients with IMA-EST were dominant at age, especially at 56 years. Meanwhile, IMA-NEST was found to be spread across different age ranges in small amounts.

Table 4. Distribution of patients by sex

Gender	Number of SKA Patients (n)	Percentage (%)
Men	71	77,2
Women	21	22,8
Total	92	100

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025.

Based on table 4, univariate analysis shows that the majority of Type 2 DM patients with SKA, i.e., with male sex as many as 71 patients (77.2%), indicating that Type 2 DM patients with SKA predominantly occur in men rather than women.

Cross-Tabulation Between Triglyceride Levels and Type 2 DM Patients with SKA at RSPAL Dr. Ramelan Surabaya for the Period January 2023-August 2025

Table 5. Cross-Tabulation of Triglyceride Levels by SKA Incidence

	SKA Incident			
Up to Triglycerida	**APTS n (%)**	**IMA-NEST n (%)**	**IMA-EST n (%)**	**Total SKA patients (n)**
Normal (<150 mg/dL)	18 (40,0)	10 (22,2)	17 (37,8)	45
High normal limit (150–199 mg/dL)	10 (43,5)	5 (22,7)	7 (31,8)	22
High (200–499 mg/dL)	10 (43,3)	2 (8,7)	11 (47,8)	23
Very high (>499 mg/dL)	0 (0,)	1 (50,0)	1 (50,0)	2
Total	**38**	**18**	**36**	**92**

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025

Based on table 5, bivariate analysis presents a table of cross-tabulation between triglyceride levels and the incidence of SKA showing that Type 2 DM patients with normal and high triglyceride levels have a fairly large proportion of APTS and IMA-EST. The category of high triglyceride levels in Type 2 DM patients experienced IMA-EST rather than IMA-NEST, but the pattern was not consistent or varied in other triglyceride categories. Meanwhile, triglyceride levels are very high in very few in Type 2 DM patients. This shows a tendency to

differ in the distribution of SKA events by category and has not shown a clear relationship pattern.

Table 6. Cross-tabulation of triglyceride levels by age and incidence of SKA

	SKA Incident	**Up to Triglycerida**				Total
Age	APTS	Normal (<150 mg/dL)	Maximum Normal Limit (150-199 mg/dL)	Height (200-499 mg/dL)	Very High (>499mg/dL)	
35		0	0	0	0	0
36		0	0	1	0	1
37		0	0	0	0	0
38		0	0	0	0	0
39		0	0	0	0	0
40		0	1	0	0	1
41		0	0	0	0	0
42		0	1	0	0	1
43		0	0	0	0	0
44		0	0	0	0	0
45		1	0	1	0	2
46		0	0	0	0	0
47		0	1	0	0	1
48		0	0	0	0	0
49		0	0	1	0	1
50		0	0	1	0	1
51		2	1	1	0	4
52		1	2	0	0	3
53		1	0	0	0	1
54		1	0	1	0	2
55		0	0	1	0	1
56		1	1	0	0	2
57		0	0	0	0	0
58		2	1	0	0	3
59		2	0	0	0	2
60		0	0	0	0	0
61		0	0	1	0	1
62		1	1	0	0	2
63		0	0	1	0	1
64		0	1	0	0	1
65		0	0	0	0	0
66		0	0	0	0	0
67		2	0	0	0	2
68		0	0	0	0	0
69		0	0	0	0	0
70		0	0	0	0	0
71		0	0	0	0	0
72		1	0	0	0	1
73		0	0	0	0	0

Age	APTS	Normal (<150 mg/dL)	Maximum Normal Limit (150-199 mg/dL)	Height (200-499 mg/dL)	Very High (>499mg/dL)	
74		0	0	1	0	1
75		0	0	0	0	0
76		0	0	0	0	0
77		1	0	0	0	1
78		1	0	0	0	1
79		0	0	0	0	0
80		0	0	0	0	0
81		0	0	0	0	0
82		0	0	0	0	0
83		0	0	0	0	0
84		0	0	0	0	0
85		1	0	0	0	1
	Total	18	10	10	0	38
Age	IMA-NEST	Normal (<150 mg/dL)	Maximum Normal Limit (150-199 mg/dL)	Height (200-499 mg/dL)	Very High (>499mg/dL)	Total
35		0	0	0	0	0
36		0	0	0	0	0
37		0	0	0	0	0
38		0	0	0	0	0
39		0	0	0	0	0
40		0	0	0	0	0
41		0	0	0	0	0
42		0	0	0	0	0
43		0	0	0	0	0
44		0	0	0	0	0
45		0	0	0	0	0
46		0	1	0	0	1
47		0	0	0	0	0
48		1	0	0	0	1
49		0	0	0	0	0
50		0	0	0	0	0
51		0	1	1	0	2
52		0	0	0	0	0
53		0	2	0	0	2
54		0	0	0	0	0
55		0	0	1	0	1
56		0	0	0	0	0
57		0	0	0	0	0
58		0	0	0	0	0
59		2	0	0	0	2
60		0	0	0	1	1
61		1	0	0	0	1
62		1	0	0	0	1

Age	IMA-NEST	Normal (<150 mg/dL)	Maximum Normal Limit (150-199 mg/dL)	Height (200-499 mg/dL)	Very High (>499mg/dL)	Total
63		1	0	0	0	1
64		0	0	0	0	0
65		0	0	0	0	0
66		0	0	0	0	0
67		1	0	0	0	1
68		0	0	0	0	0
69		0	0	0	0	0
70		0	0	0	0	0
71		1	0	0	0	1
72		0	0	0	0	0
73		0	0	0	0	0
74		0	0	0	0	0
75		0	0	0	0	0
76		0	0	0	0	0
77		1	0	0	0	1
78		0	0	0	0	0
79		0	0	0	0	0
80		1	0	0	0	1
81		1	0	0	0	1
82		0	0	0	0	0
83		0	0	0	0	0
84		0	0	0	0	0
85		0	0	0	0	0
	Total	10	5	2	1	18

Age	IMA-EST	Normal (<150 mg/dL)	Maximum Normal Limit (150-199 mg/dL)	Height (200-499 mg/dL)	Very High Very High (>499mg/dL)	Total
35		0	1	0	0	1
36		0	0	0	0	0
37		0	0	0	0	0
38		0	0	0	0	0
39		0	0	0	0	0
40		0	0	0	0	0
41		0	0	0	0	0
42		0	0	0	0	0
43		0	0	0	0	0
44		0	0	0	0	0
45		1	0	0	0	1
46		0	0	0	0	0
47		0	0	0	1	1
48		1	0	0	0	1
49		1	0	0	0	1
50		0	0	0	0	0
51		1	1	0	0	2
52		1	0	0	0	1

53	0	2	0	0	2
54	1	0	2	0	3
55	0	0	0	0	0
56	2	2	1	0	5
Age IMA-NEST	Normal (<150 mg/dL)	Maximum Normal Limit (150-199 mg/dL)	Height (200-499 mg/dL)	Very High (>499mg/dL)	Total
57	1	0	0	0	1
58	0	0	0	0	0
59	0	0	0	0	0
60	0	0	3	0	3
61	0	0	0	0	0
62	1	0	0	0	1
63	1	0	1	0	2
64	0	0	2	0	2
65	1	0	1	0	2
66	0	0	0	0	0
67	1	0	1	0	2
68	0	0	0	0	0
69	1	0	0	0	1
70	1	0	0	0	1
71	1	0	0	0	1
72	0	0	0	0	0
73	0	0	0	0	0
74	1	0	0	0	1
75	0	0	0	0	0
76	0	0	0	0	0
77	0	0	0	0	0
78	0	0	0	0	0
79	0	0	0	0	0
80	0	0	0	0	0
81	0	0	0	0	0
82	0	0	0	0	0
83	0	1	0	0	1
84	0	0	0	0	0
85	0	0	0	0	0
Total	17	7	11	1	36

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025

Based on table 6, bivariate analysis presented a table of cross-tabulation between triglyceride levels and the incidence of SKA and age showed that, from the total of all SKA patients, the distribution of SKA incidence was found that APTS was found in 38 patients (41.3%), followed by IMA-EST found in 36 patients (39.1%) and IMA-NEST was found in 18 patients (19.6%).

Based on the distribution of age groups, it was found that the age group of ≤55 years there were 40 patients (43.5%). In the age group of ≤55 years, the incidence of SKA was found in various categories of triglyceride levels, ranging from normal to high levels. This pattern

can be related to the characteristics of age groups that are still in productive age who tend to have unhealthy lifestyle patterns such as dietary habits high in fat and simple carbohydrates, less active physical activity has the potential to affect lipid profiles, including triglyceride levels that are at risk of SKA events.

In the age group of >55 years, there were 52 patients (56.5%) with the incidence of SKA. In this age group, it was found in various categories of triglyceride levels, with the highest number in the normal category and the highest normal limit, while the number of patients with high and very high triglyceride levels was relatively smaller. This condition may reflect that in old age, some patients have become more aware of the importance of controlling risk factors such as lifestyle control, namely with awareness of maintaining diet, limiting fat intake, and adherence to medical therapy, so that triglyceride levels tend to be more controlled even though cardiovascular risk continues to increase due to age factors and other comorbidities.

Thus, the difference in the distribution of triglyceride levels by age group suggests that the incidence of SKA in patients with type 2 diabetes is not solely determined by triglyceride levels, but is the result of the interaction of various multifactorial risk factors, including age, gender, lifestyle factors such as diets high in fat and sugar, lack of physical activity, smoking and alcohol habits, and other age-related metabolic and cardiovascular factors.

Spearman Correlation Test of Triglyceride Levels with the Incidence of SKA in Type 2 DM Patients at the Heart Polyclinic of RSPAL dr. Ramelan Surabaya

Table 7. Spearman Correlation Test Results

Variable	Correlation Coefficient (r)	*p-value*
Triglyceride levels – Incidence of SKA	0,034	0,745

Data Source: Secondary data obtained from medical records of Type 2 DM patients with ACS at the Heart Polyclinic of RSPAL Dr. Ramelan Surabaya, January 2023–August 2025

Based on table 7, the results of the Spearman correlation test based on ordinal-scale data show that the value of the correlation coefficient (r= 0.034) with a significance value of p= 0.745 (p > 0.05). It can be concluded that there is no statistically significant relationship between triglyceride levels and the incidence of SKA in Type 2 DM Patients at RSPAL dr. Ramelan Surabaya for the period January 2023-August 2025.

Research Results Based on Distribution

Based on the results of the distribution of triglyceride levels in type 2 DM patients with SKA, it was found that the majority of type 2 DM patients with SKA showed lipid metabolism disorders, characterized by normal ≥triglyceride levels, based on the distribution of SKA incidence it was obtained that the majority of type 2 DM patients with SKA experienced APTS, followed by IMA-EST, while IMA-NEST was the event with the lowest proportion in patients, Based on the age distribution, the results of most type 2 DM patients with SKA were at the age of ≤55 years, as many as 40 patients (43.5%) were dominated by APTS followed by IMA-EST and at least IMA-NEST. Meanwhile, at the age of >55 years, 52 patients (56.5%) experienced the most IMA-EST, followed by APTS and IMA-NEST, which was found with the lowest proportion and spread across various age groups without a certain age dominance. This is in

line with epidemiological and prevalence theories that Type 2 DM patients currently occur in all adult and productive age groups, but are more prevalent in older age groups (Khan et al., 2020). Based on the distribution by sex, it shows that Type 2 DM patients with ALS predominantly occur in men rather than women, in accordance with theories and epidemiological studies that state that the prevalence of Type 2 DM patients is consistently and the majority are male than female (Einarson et al., 2018; Kautzky-Willer et al., 2023; Khan et al., 2020).

Research Results Based on Cross-Tabulation

Based on the results of cross-tabulation between triglyceride levels and the incidence of SKA in type 2 DM patients at RSPAL dr. Ramelan Surabaya for the period January 2023-August 2025, it was found that the distribution of SKA incidence varied in each triglyceride level category.

The distribution of SKA incidence based on triglyceride levels of Type 2 DM patients with normal or high triglyceride levels has a considerable proportion of APTS and IMA-EST incidence. The high triglyceride category tends to experience more IMA-EST than IMA-NEST, but the overall pattern still varies in other triglyceride categories. Meanwhile, based on the distribution of age groups, APTS is the most common incidence of SKA in the age group of ≤55 years, while IMA-EST is more dominant in patients in the age group of >55 years. The majority of Type 2 DM patients with SKA were men, with 71 patients (77.2%), indicating that men were at higher risk than women in the study population.

Thus, the incidence of SKA in Type 2 DM patients at RSPAL Dr. Ramelan Surabaya for the period January 2023-August 2025 is influenced by the interaction of triglyceride levels with the more dominant age and gender risk factors, namely age and gender, namely age >55 years and male gender. Multifactorial interpretation is associated with the pathogenesis of complex CKA events, namely between dyslipidemia factors, degree of coronary occlusion, coronary plaque stability, glycemic control and clinical variables such as LDL, HDL and duration of suffering from Type 2 DM which were not analyzed in depth in this study, but it was found that age and gender factors are crucial dominant contributors in this study in influencing the occurrence of CKA in Type 2 DM patients.

Research Results Based on the Spearman Test

The results of the Spearman correlation test based on ordinal-scale variable data showed that the value of the correlation coefficient ($r = 0.034$) with a significance value of $p = 0.745$ ($p > 0.05$). It can be concluded that there is no statistically significant relationship between triglyceride levels and the incidence of SKA in Type 2 DM Patients at RSPAL dr. Ramelan Surabaya for the period January 2023-August 2025.

CONCLUSION

This observational analytical cross-sectional study, conducted on 92 type 2 DM patients with ACS at the Cardiac Polyclinic of RSPAL Dr. Ramelan Surabaya from January 2023 to August 2025, found no statistically significant relationship between triglyceride levels and the incidence of ACS, with a Spearman correlation coefficient of 0.034 ($p>0.05$). Triglyceride levels among patients varied, with the majority falling within the normal range (<150 mg/dL), though this nonetheless reflects the presence of lipid metabolism disorders in this population. The most common ACS subtype was UAP, followed by STEMI and NSTEMI, and the study

population was predominantly male (77.2%) and over 55 years of age (56.5%). These findings suggest that triglyceride levels alone may not be a reliable predictor of ACS incidence in type 2 DM patients, likely because the pathogenesis of ACS in this population is multifactorial, involving not only dyslipidemia but also hyperglycemia, inflammation, oxidative stress, and endothelial dysfunction. Future research is recommended to adopt a longitudinal or prospective cohort design with a larger and more diverse sample, incorporating a broader panel of lipid and metabolic markers — such as LDL particle size, HDL cholesterol, HbA1c, and the triglyceride–glucose (TyG) index — to more comprehensively characterize the cardiovascular risk profile of type 2 DM patients and identify stronger predictors of ACS in this population.

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