



## Relationship of Lipid Profile with Wagner Severity Level in Diabetic Feet at General Hospital Dr. M. Djamil Padang

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### ARTICLE INFO

#### Keywords:

DM  
Diabetic Foot  
Lipid Profile  
Wagner Severity Level

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All authors have reviewed and approved the final version of the manuscript.

<https://doi.org/10.32539/BJI.v7i1.276>

### ABSTRACT

**Introduction** Diabetic foot is an erosion or injury to the epidermis or the distal sole of the foot and the base of the foot in people with diabetes mellitus (DM). Diabetic foot is a major cause of limb amputation in non-traumatic cases. Per year, as many as 2-3% of people with diabetes experience complications of diabetic foot. The prevalence of DM sufferers with diabetic foot is 20-40% in developing countries. In Indonesia, the prevalence of DM sufferers with diabetic foot is around 15% with 32% mortality rate. One factor plays an important role in predisposing the occurrence of diabetic foot is the lipid profile. The aim of this study was to determine the correlation between lipid profile and Wagner Severity Level on diabetic foot patients at Dr. M. Djamil Central Public Hospital, Padang in the period of July 2020 to December 2020. **Method:** This research is an observational analytic study with cross sectional analytic design. The research sample of 47 cases was taken by non-probability sampling with the consecutive sampling method. This research is an observational analytic study with cross sectional analytic design. The research sample of 47 cases was taken by non-probability sampling with the consecutive sampling method. **Result:** There were 47 cases that met the inclusion criteria where the 51-60 years age group (55.3%) was the largest group in cases of diabetic foot. Of these groups, it was dominated by female patients, namely 31 patients (66.0%). Meanwhile, the Body Mass Index (BMI) was dominated by the group with BMI <25 kg/m<sup>2</sup> with a total of 26 patients (55.3%). Diabetic foot patient at Dr. M Djamil Central Public Hospital Padang who underwent amputation was 25 patients (53.2%) where most of them, namely 40 patients (85.1%) had suffered from Diabetes Mellitus for > 5-10 years. The findings obtained based on the Wagner Severity Level were that the Wagner grade 3-5 (heavy) group consisted of 24 people (51.1%) and Wagner 1-2 (mild) as many as 23 people (48.9%). The results of the bivariate test between lipid profile levels with Wagner Severity Level in diabetic foot patients showed a significant correlation as indicated by a p value <0.05. **Conclusion:** Wagner Severity Level which is getting higher in diabetic foot patients shows low HDL levels, high LDL levels and high levels of triglycerides in blood plasma.

### 1. Introduction

Diabetes mellitus (DM) is experienced by approximately 415 million people with an average age range of 20-79 years in the world and spread in almost all parts of the world. From several research studies that have been conducted previously, WHO predicts that there will be an increase in diabetes mellitus patients in the world to as many as 642 million people in 2040.

Approximately 153 million people with diabetes mellitus among them originate or live in western Pacific countries, including Indonesia.<sup>1</sup> Indonesia is the fourth most populous country in the world with approximately 258 million inhabitants and is one of 21 countries that are under the auspices of the International Diabetes Federation Western Pacific Region. In 2015, Indonesia was ranked

seventh in the world for the highest prevalence of diabetes mellitus sufferers in the world along with China, India, the United States, Brazil, Russia and Mexico. 1 In 2017 the International Diabetes Federation stated that there were approximately 10.3 million people recorded. Indonesia with diabetes mellitus.<sup>2</sup>

Diabetes mellitus (DM) is a chronic disorder characterized by disorders of carbohydrate, protein, and fat metabolism as a result of a number of factors with absolute or relative insulin deficiency and insulin function disorders. Uncontrolled blood sugar levels can cause microvascular complications, namely retinopathy, neuropathy and nephropathy. Meanwhile, macrovascular complications include heart disease, peripheral vascular disease and stroke. Diabetes mellitus sufferers compared to non-diabetes mellitus sufferers have a tendency to be 2 times more prone to cerebral thrombosis, 25 times more likely to experience blindness, 2 times more likely to develop coronary heart disease, 17 times more likely to experience chronic kidney failure and 50 times more prone to leg diabetic.<sup>3</sup>

Diabetic foot is the leading cause of limb amputation in non-traumatic cases. Diabetic foot is a health problem that has a negative effect on the quality of life and causes a heavy economic burden on the patient, family and country, because it requires long hospital care and rehabilitation services. Patients with diabetes mellitus 2-3% will experience complications of diabetic foot every year. The prevalence of diabetes mellitus sufferers with diabetic foot in the United States is around 15-20%, the risk of amputation is 15-46 times higher than that of people with non-diabetes mellitus. It is estimated that 15-20% of people with diabetes mellitus will experience limb amputation in the course of the disease. Research conducted by Driver et al, 2104 stated that after amputation 13-40% of sufferers only survive a period of 1 year and 39-80% will survive within 5 years, this is comparable to deaths caused by all types of cancer in the same period.<sup>2,4</sup>

The prevalence of diabetes mellitus sufferers with diabetic feet in developing countries is found to be much greater than that in developed countries, which is between 20-40%, while the prevalence of diabetes mellitus sufferers with diabetic feet in Indonesia is around 15% with a mortality rate of 32% and is the largest cause for treatment. hospital.<sup>2,4</sup>

In Indonesia, data from the Cipto Mangunkusumo Hospital (RSCM) states that the problem of diabetic foot is still a big problem. Most of the treatment for diabetes mellitus patients is always caused by their diabetic foot. In 2007, from 327 diabetes mellitus patients who were treated at RSCM, 111 of them were diagnosed with diabetic foot. The mortality rate due to ulcers or gangrene ranges from 17-23% while the amputation rate ranges from 15-30%. The mortality rate one year after amputation was around 14.8% and this number increased in the third year to 37%.<sup>5</sup>

Outpatient visit data on the profile of Dr. M. Djamil Padang in 2013 explained that diabetes mellitus was one of the top 10 most diseases, namely 7,994 cases and was in the second place of most visits. Installation of Medical Records RSUP dr. M. Djamil Padang reported that diabetic foot is still a big problem. This is based on data from outpatient and inpatient installation disease index reports that most of the care and treatment for diabetes mellitus patients always involves diabetic feet and there is an increase in the number of cases every year.<sup>6</sup>

Research conducted in 2015 in West Sumatra, especially Padang Pariaman, Padang, Solok, and Padang Panjang, showed that the average fat consumption of respondents was  $40.29 \pm 19.78$  grams, with the lowest fat consumption being 5.10 grams and the highest was 112.60 grams where the average calorie consumption was the mean is  $1597.48 \pm 493.58$  kcal. Researchers also conducted research on 656 patient respondents at Dr. M Djamil Padang obtained an average total cholesterol of  $\geq 240$  mg / dL. Hatma's cross-sectional study in 2017 also showed that the

prevalence of dyslipidemia was higher in the Minangkabau ethnic group, based on total and LDL cholesterol values.<sup>7</sup>

Diabetic foot is not an unavoidable condition, because most cases of diabetic foot should be preventable. Prevention of diabetic foot in diabetes mellitus patients is very important considering the many factors that support the occurrence of diabetic foot in diabetes mellitus patients. One of the factors that play an important role in predisposing the occurrence of diabetic foot is the lipid profile. Research conducted by Lamarche et al., 1997 states that diabetic foot is associated with atherosclerosis which occurs due to dyslipidemia in diabetes mellitus patients which is characterized by low levels of high-density lipoprotein (HDL-cholesterol), increased triglycerides and low-density lipoprotein (LDL-particles). cholesterol) in the blood plasma.<sup>8</sup>

Studies on the relationship of lipid profiles with diabetic feet have also been conducted by several previous researchers, research conducted by Saima et al., 2020 said that there was an increase in LDL-cholesterol and triglycerides in diabetes mellitus patients with diabetic feet compared to diabetes mellitus patients without diabetic foot complications.<sup>9</sup>

Different results were obtained in research conducted in research conducted by Wien et al, 2014 at RSUD DR. H. Abdul Moeloek in Bandar Lampung, the results of the study showed no significant results between the total cholesterol and triglyceride values with the incidence of diabetic foot in diabetes mellitus patients. Based on the description above, the researcher is interested in examining the relationship between the lipid profile and the degree of diabetic foot based on Wagner's classification at dr. M. Djamil Padang.<sup>10</sup>

## 2. Method

This research is an observational analytic study with cross sectional analytic design. The research sample of 47 cases was taken by non-

probability sampling with the consecutive sampling method. The sample criteria were diabetic foot patients who came to Dr. M. Djamil Padang with complete medical data. Meanwhile, patients who have had previous operative action, smoking, uncontrolled hypertension and diabetes mellitus > 10 years were excluded from the study sample. Data collection was carried out by recording medical record data regarding the characteristics of diabetic foot patients, lipid profiles including HDL, LDL, and triglycerides, and assessment with Wagner Severity Level. Data processing uses a computer program to assess the relationship between variables.

## 3. Result

Overall research subjects were 47 cases. The characteristics of the research subjects can be seen in table 1. Based on table 1, the characteristics of diabetic foot research subjects are as follows, the age group of diabetic foot cases is mostly in the 51-60 years age group (55.3%). Based on gender, it was found that the gender of 31 people (66.0%) and 16 men (34.0%), while the Body Mass Index (BMI) was dominated by the group with BMI <25 kg/m<sup>2</sup> as many as 26 people (55.3%). Diabetic foot patient at RSUP Dr. M Djamil Padang who performed amputation as many as 25 people (53.2%), most of the patients had suffered from Diabetes Mellitus > 5-10 years as many as 40 people (85.1%). Based on the Wagner Severity Level, it was found that the Wagner group 3-5 (heavy) 24 people (51.1%) more than Wagner 1-2 (mild) 23 people (48.9%).

The lipid profiles assessed in diabetic foot patients are High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL) and Triglycerides. The results of univariate analysis between lipid profile variables based on frequency distribution with categorical data scales and frequency distribution with numerical data scales can be seen in the following table.

An overview of the lipid profile in diabetic foot patients can be seen in table 5.2.1. HDL was

dominated by the group with low HDL as many as 36 people (76.6%) and LDL was dominated by the group with high LDL as many as 38 people (90.9%), while based on triglycerides was dominated by the high triglyceride group as many as 32 people (68.1%).

Based on table 5.2.2, it shows that the average LDL level is 180.32 mg / dl. HDL levels averaged 29.28 mg / dl. Triglyceride levels averaged 237.87 mg / dl.

The percentage of cases with mild Wagner classification was higher in the group with normal HDL than in the severe Wagner classification, namely 90.9% versus 9.1%. Based on the calculation of statistical tests, significant results

were obtained with a p-value of 0.002.

The percentage of cases with severe Wagner classification was higher in the group with high LDL than in the mild Wagner classification, namely 41.1% versus 11.1%. Based on the calculation of the statistical test, significant results were obtained with a p-value of 0.023.

The percentage of cases with severe Wagner classification was higher in the group with high triglycerides than in the mild Wagner classification, namely 80.0% versus 20.0%. Based on the calculation of the statistical test, it was obtained significant results with a p-value of 0.011.

Table 1: Characteristics of Research Subjects

Characteristics	f	%
<b>Age</b>		
< 30	1	2.1
31 – 40	5	10.6
41 – 50	2	4.3
51 – 60	26	55.3
> 60	13	27.7
<b>Gender</b>		
Male	16	34.0
Female	31	66.0
<b>BMI</b>		
<25	26	55.3
25-30	17	36.2
> 30	4	8.5
<b>Action</b>		
Amputation	25	53.2
Non-amputation	22	46.8
<b>DM history</b>		
<5 years	7	14.9
5-10 years	40	85.1
<b>Wagner's classification</b>		
Wagner 1-2 (light)	23	48.9
Wagner 3-5 (weight)	24	51.1

Table 2: Lipid Profiles of Diabetic Foot Patients at RSUP Dr. M. Djamil Padang

<b>Lipid Profile</b>	<b>F</b>	<b>%</b>
<b>HDL</b>		
Normal	11	23.4
Low	36	76.6
<b>LDL</b>		
Normal	9	19.1
High	38	90.9
<b>Triglycerides</b>		
Normal	15	31.9
High	32	68.1

Table 3: Average Lipid Profiles of Diabetic Foot Patients in Dr. M. Djamil Padang.

<b>Lipid Profile</b>	<b>N</b>	<b>Average</b>	<b>Standart deviation (±)</b>
<b>HDL</b>	47	180.32	35.83
<b>LDL</b>	47	29.28	15.82
<b>Triglycerides</b>	47	237.87	54.837

Table 4: Relationship between HDL and Wagner Severity Level

HDL	Wagner Severity Level				P value
	Light		Severe		
	f	%	f	%	
Low	13	36.1	23	63.9	0.002
Normal	10	90.9	1	9.1	

Table 5: Relationship between LDL and Wagner Severity Level

LDL	Wagner Severity Level				P value
	Light		Severe		
	f	%	f	%	
Normal	22	57.9	8	27.9	0.023
High	1	11.1	16	41.1	

Table 6: Relationship between Triglycerides and Wagner Severity Level

Triglycerides	Wagner Severity Level				P value
	Light		Severe		
	f	%	f	%	
Normal	20	62.5	5	37.5	0.011
High	3	20.0	19	80.0	

#### 4. Discussion

In this study, a total sample of 47 people was obtained from July 2020 to December 2020. The sampling technique in this study used non-probability sampling with the consecutive

sampling method. Based on gender, it was found that the gender was 16 men (34.0%) and 31 women (66.0%). Body Mass Index (BMI) was also dominated by the group with BMI <25 kg / m<sup>2</sup> as many as 26 people (55.3%). There were 25 diabetic

foot patients who were amputated (53.2%) and most of the patients had diabetes mellitus > 5-10 years as many as 40 people (85.1%). Based on the Wagner Severity Level, it was found that the Wagner group 3-5 (heavy) 24 people (51.1%) more than the Wagner 1-2 (light) group 23 people (48.9%).

This study in terms of patient characteristics based on age shows that the most diabetic foot patients are in the 51-60 years age group (55.3%), this is in accordance with a study in Switzerland cited by Suwondo that most patients with diabetic foot are aged  $\geq 60$  years, and research In a case control case in Iowa by Robert, it was shown that the age of diabetic foot sufferers at the age of  $\geq 60$  years was 3 times more than the age <55 years. the ability of the body to function to control high blood glucose is less than optimal.<sup>13</sup>

The results of this study also found that women had more diabetic feet as many as 31 people (66%) while men 16 people (34%). This contrasts with the cross-sectional study conducted by Al-Rubean, which showed that the incidence of diabetic foot was significantly higher in patients with male sex than female. However, due to the complex pathophysiology of diabetic foot, further research is needed regarding the relationship between sex and the incidence of diabetic foot.<sup>14</sup>

In this study, 25 patients (53.2%) underwent amputation. So that the results of this study are in line with the results of several previous studies in various countries. One of them is a study conducted in South Korea with the results showing the incidence of lower limb amputation was found to be 48.9% (67 patients with major amputations and 5 patients with minor amputations). From this study, it was found that the high number of amputations in the study sample was caused by the patients who were taken as the study sample coming to the hospital with severe disease conditions.<sup>15</sup>

Based on the Wagner Severity Level, the results were the Wagner 1-2 group (mild) 23 people (48.9%) and Wagner 3-5 (heavy) 24 people

(51.1%). This is in line with the results of several previous studies where it was found that the percentage of patients with severe Wagner classification was found more than mild Wagner classification. The difference in the population of the study sample is what affects the percentage of Wagner's classification obtained in these two studies<sup>16</sup>

The results showed that the case presentation of mild Wagner classification was higher in the group with normal HDL compared to the severe Wagner classification, namely 90.9% versus 9.1%. The bivariate test results regarding the relationship between HDL levels and the Wagner Severity Level of diabetic foot patients stated that there was a relationship between HDL levels and the incidence of diabetic foot with a P value of 0.002 ( $p < 0.05$ ). Statistically, it was found that normal HDL levels will reduce the severity of diabetic foot. These results are in accordance with the previous theory that HDL cholesterol functions to reduce apoptosis and stimulate endothelial cell proliferation and migration. Based on the statistical test results of the Independent sample Chi-Square Test, the p-value was 0.002, meaning that there was a significant relationship between HDL levels and Wagner's Severity Level. Patients with the smallest HDL levels had heavier Wagner Severity Levels, while the largest HDL levels had lighter Wagner Severity Levels. This can be explained by understanding the activity of HDL on blood vessels. HDL has anti-inflammatory and atheroprotective properties so that it can promote wound healing and prevent ulcers that can worsen the Wagner Severity Level in diabetic foot.<sup>17</sup>

This study showed that the case presentation of the severe Wagner classification was higher in the group with high triglycerides than in the mild Wagner classification, namely 80.0% versus 20.0%. The results of the bivariate test regarding the relationship between triglyceride levels and Wagner Severity Level in diabetic foot patients stated that there was a significant relationship with a p-value of 0.011 ( $p < 0.05$ ). Statistically, it

was found that high triglyceride levels will increase the severity of diabetic foot. This is associated with an increase in abnormal lipid metabolism in conditions of insulin resistance<sup>17</sup>

This study also showed the percentage of cases in the severe Wagner classification was higher in the group with high LDL than in the mild Wagner classification, namely 41.1% versus 11.1%. The bivariate test results regarding the relationship between LDL levels and the Wagner severity level of diabetic foot patients stated that there was a relationship between LDL levels and the incidence of diabetic foot with a p-value of 0.023 ( $p < 0.05$ ). Statistically, it was found that high LDL levels will increase the severity of diabetic foot. This is in accordance with the theory, where LDL cholesterol levels in plasma are directly proportional to the oxidation process which converts LDL into foam cells. When the body experiences insulin resistance, there will be an increase in the amount of small dense LDL. This high cholesterol concentration will lead to complications of atherosclerosis in uncontrolled diabetes patients for a long time. Apoptosis in endothelial cells leads to atherosclerosis and other blood vessel disorders. Several factors causing apoptosis in the endothelium include oxidized LDL and tumor necrosis factor- $\alpha$  (TNF $\alpha$ ). Oxidized LDL causes an increase in intracellular Ca which results in cell death.<sup>18</sup>

#### 5. Conflict of Interest : -

#### 6. Funding : -

#### 7. Author Contributions

Yunes Ario was responsible for data collection, research administration and writing the original draft. Rafli Rustam and Vendry Rivaldi were responsible for the statistical analysis and writing of the original draft. All authors have reviewed the latest version of the manuscript.

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