Interferon-Gamma Level and Affecting Factor in DM Patients at Public Health Center

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Abstract. The study aims to understand the interferon-gamma (IFN-γ) level and affecting factors in diabetes mellitus (DM) patients at Public Health Center (PHC). This cross-sectional study was conducted on 153 DM patients. The inclusion criteria were male or female patients over 18 years old diagnosed with DM for three months. They stated their willingness to study Interviews were conducted to obtain exercise habits data. We carried out laboratory measurements of random blood sugar(RBS), triglycerides TG, and IFN-γ. Data are presented descriptively and analytically. Most subjects were women with no smoking, hyperglycemia, and hypertriglyceridemia. RBS and TG were higher than the target, 257.88 ± 117.76 mg/dl and 204.66 ± 103.83 mg/dl, respectively. Hemoglobin (Hb) (12.95 ± 1.49), leukocyte (8.96 ± 1.96), platelet (321.24 ± 0.74), and erythrocytes (4.53 ± 0.55) were normal. There was no difference in IFN-γ levels based on gender, age group, obesity status, hyperglycemia status, hypertriglyceridemia, and hypertension status. Conclusion: There was no difference in IFN-γ levels based on demographic and clinical characteristics in DM patients at the JPHC.

Keywords: diabetes mellitus · IFN-γ levels · blood sugar levels · primary health care

1 Introduction

Chronic disorders such as diabetes mellitus (DM), is characterized by elevated blood sugar [1]. It has been established that hyperglycemia or dyslipidemia plays a significant part in this inflammatory process, which might adversely affect diabetes disease progression and complications [2]. Acute or long-lasting problems might result from uncontrolled blood sugar levels [3]. According to studies conducted in Singapore and Indonesia, elevated blood glucose levels are linked to a decline in the quality of life for people with diabetes [4]. IFN-γ levels that are too high are linked to an increased inflammatory response, whereas IFN-γ levels that are too low are linked to a reduced prognosis. Chronic inflammation, indicated by elevated pro-inflammatory markers, is present in

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DM. In DM patients, the immune system responds less because of chronic inflammation [5]. Impaired cytokine production is another side effect of chronic hyperglycemia [6]. Dyslipidemia is a condition that frequently affects people with DM [7].

Various pro-inflammatory cytokines will rise with increased adipose tissue [8].

IFN- is a cytokine that promotes inflammation and functions as an immunomodulator [5], IFN- will cause NK cells, macrophages, and other leukocyte cell types to migrate by activating them [6]. Hyperglycemia or dyslipidemia leadsto activation of Toll like receptors and activation of interferon alpha signaling and production of proinflammatory cytokines [9]. The main causes of DM include hyperglycemia, microangiopathy caused by ischemia and hypoxia, inflammation, and leukocyte stasis, as well as oxidative stress, mitochondrial dysfunction, microRNAs, and other molecular mechanisms [10]. In previous studies, it was known that DM patients had lower IFN-γ levels than non-DM [5, 11, 12]. Factors related to IFN-γ levels in DM patients have not been widely studied. This study aims to determine the IFN-γ and glucose levels based on the clinical profile of DM patients.

2 Method

2.1 Research Design

We conducted cross-sectional study in 153 diabetes at the Public Health Center (PHC). Data collection is carried out prospectively from 2019–2022. The research protocol has been reviewed, and an ethical suitability letter has been issued from the Ahmad Dahlan University Ethics Committee.

2.2 Subjects and Sample Size

Patients at PHC, Yogyakarta who had type 2 diabetes were the study's target population. Patients with type 2 diabetes seeking treatment at PHC, Yogyakarta, made up the inexpensive community accessible demographics that complied with the inclusion and exclusion requirements made up all of the research participants.

Patients must be adults, male or female, and at least 18 years old. They must also be diabetic patients with hypertension and willing to engage in the study. Patients with diabetes mellitus (DM) who had mental problems, or kidney diseases were not included in the study.

According to the database, there are 216 patients with DM type 2 overall in the PHC. The Lemeshow formula was employed in the study to ensure that at least 120 patients were represented in the minimal number of samples.

2.3 Research Instrument

We used questionnaires to collect demographic information and life style's patient primary data. The data retrieval form is used to gather clinical information.

2.4 Research Procedure

There are three steps to the research process. At the Regional Development Planning Agency, the researcher obtained the permissions for the initial phase of the study. Then, we created the questionnaires and forms for data retrieval, supporting tools, an initial research, and training for data collectors. The execution phase is the next stage. In this stage, the subject was chosen by the researcher. The inclusion criteria comprised data from patients who had been medically confirmed to have diabetes by staff at the PHC, Yogyakarta. Prospective participants who met the criteria for participation were then given a description of the study's goals and advantages. In the study when the patient completed the informed consent form, patients who consented to serve as subjects were requested to provide their signature.

Patients who have given written informed consent were interviewed by the researcher. Researchers filled out data collection forms with laboratory data, blood pressure, clinical condition and diagnoses. Then, interviews were done to ascertain lifestyle. From the patient's serum sample, the levels of triglycerides, immediate blood glucose, and IFN were measured. The levels of IFN was measured using ELISA techniques.

2.5 Data Analysis

An summary of the frequency distribution (percentage) of patient features based on demographics was obtained using univariate analysis. The bivariate method When blood glucose and IFN-γ level data were regularly distributed, a non-paired sample test was performed to ascertain the variance in mean blood glucose levels.

3 Results and Discussion

3.1 Characteristics of Respondents

There were 153 DM patients at the Public Health Center who were involved in the study. Table 1 lists the characteristics of test subjects.

The majority of the participants were female, under 65 years old, had a basic level of education, worked in non-state civil service, did not smoke, did not exercise, and consumed a diet high in carbohydrates. The clinical characteristics of DM patients in the PHC are presented in Table 2.

The patient is 57.39 years old on average, according to Table -2. The mean blood sugar and triglyceride levels were higher than average; they were 261.70 ± 121.15 mg/dl and 202.11 ± 108.82 mg/dl, respectively. The range of several clinical markers is normal.

3.2 IFN-Γ and Glucose Levels in DM Patients and Related Factors

The results of Table 3 show that there is no difference between INF-γ and glucose levels between males and females, with a p-value greater than 0.05 ($p > 0.05$).

This study differs from the previous study in determining INF-γ cytokines in patients with metabolic syndrome[6]. The study's results stated that the INF-γ cytokine showed a significant relationship with plasma glucose levels even when compared with age and

Table 1. The demographics of 153 patients with DM at Yogyakarta's PHC

Demographic Characteristic		Freq	Percentage
Sex	Male/female	49/104	32/68
Marital status	Marital	153	100
Age group	$<$ 65 year / $\geq$ 65 year	124/29	81.05/18.95
Education status	Basic/advanced	111/42	72.5/27.5
Health assurance	BPJS/others	124/29	81/19
Job	Non-state civil apparatus and national army	131	85.6
Exercise habit	No /yes	92/62	60.9/39.9
Smoke behavior	No/yes	127/26	83/17
Carbohydrate diet status	No/yes	22/131	14.4/85.6
Illness duration	$<$ 6/ $\geq$ 6 year	77/76	50.3/49.7
Comorbidity status	No/yes	62/91	40.52/59.48
Comorbidity status	No /yes	62/71	31.8/68.2

Table 2. Overview of the clinical circumstances of the PHC's DM patients (n = 153)

Characteristic	Mean ± SD
Age (year)	57.39 ± 8.27
Body weight (kg)	56.60 ± 12.10
Heigh (cm)	154.62 ± 15.83
BMI (kg/cm2)	22.90
SBP (mmHg)	139.64 ± 20.52
DBP (mmHg)	80.69 ± 11.28
blood glucose level (mmHg)	261.70 ± 121.15*
Triglycerides level (mg/dl)	202.11 ± 108.82*

Note SBP = systolic blood pressure; DBP = diastolic blood pressure

gender [13]. Men are more prone to hyperglycemia than women. However, other studies have also stated that type 2 diabetes mellitus is more dominant in women than men, because women are more likely to experience hyperglycemia. Diabetes mellitus is more common in women [14]. However, research by Khan et al. (2011) which states that men are more susceptible to diabetes mellitus than women, this occurs in South Asia and China [15].

Table 3 shows that there is no significant difference between INF-γ and glucose levels with age under 60 years and above 60 years, with p value greater than 0.05 ($p > 0.05$). This study is different from the previous research. The Framingham Offspring

Table 3. Results of analysis of INF-γ and glucose levels based on demographics and clinical characteristics of DM patients at PHC.

Characteristic	IFN-γ		Random glucose level	
	Level	p	Level	p
Age group				
< 60 year	155.65 ± 26.8	0.5	274.32 ± 100.16	0.11
> 60 year	157.25 ± 30.9a		236.13. ± 113.6a	
Sex				
Male	162.32 ± 31.81	0.09	230.63 ± 104.21	0.08
Female	154.31 ± 26.52a		274.42 ± 103.38a	
Smoking behavioral				
Smoker	155.37 ± 21.90	0.6	260.36 ± 99.63	0.45
Non smoker	156.32 ± 32.06		265.73 ± 110.05	
Obesity status				
Obesity	153.27 ± 34.72	0,32	258.80 ± 79.81	0.32
No obesity	156.85 ± 27.82		263.62 ± 106.42	
Hypertension status				
Hypertension	159.42 ± 28.69	0,19	257.52 ± 106.59	0.5
No-hypertension	151.29 ± 26.34		272.84 ± 103.43	
Hypertriglyceridemia status				
hypertriglyceridemia	159.29 ± 31.75	0.41	249.72 ± 98.24	0.32
No-hypertriglyceridemia	154.28 ± 25.41		272.31 ± 108.31	

Study (2004) found that in participants aged 26–82 years there were 29.4% males and 23.1% females [16]. The occurrence of diabetes mellitus 2 in those over 55 years of age. This is related to increasing age [17].

The results of table 3 show that interferon-gamma and glucose levels are not different from smoking habit status. DM patients smoked and did not smoke there was no difference in IFN-γ and glucose levels ($p > 0.05$). Components in cigarettes, such as nicotine, have an immunosuppressive effect by inhibiting innate and adaptive immune responses [18], so smoking can affect cytokine levels such as INF-γ and IL-6. INF-γ is a cytokine that activates macrophages in innate and adaptive immune responses [19]. IL6 is a cytokine that stimulates the growth of antibodies produced from B lymphocytes [20, 21].

With all currently recognized clinical symptoms, such as hypertension, diabetes mellitus, hypertriglyceridemia, and obesity, Table 3 demonstrates no difference between INF- and glucose levels ($P > 0.05$). This is different from the previous research [6]. This study shows no relationship between the degree of obesity and fasting blood sugar levels. Hyperglycemia is associated with an increased risk of hypertension due to changes in vascular elasticity. Hyperglycemia causes oxidative stress and stimulates inflammatory

reactions and activation of endothelial cells [22]. Some literature associates hypertension with insulin resistance [7]. The hardening of the arteries is what causes hypertension's impact on the prevalence of diabetes mellitus [23].

The results showed that people with hypertension had a greater risk of developing diabetes, with 6.85 times greater odds than people without hypertension. Insulin resistance and dyslipidemia were higher in obese adolescents than in normal adolescents, and a significant relationship was found between insulin resistance and dyslipidemia. High blood pressure is also related to obesity and insulin resistance. Triglyceride and LDL cholesterol levels are likely to rise as a result of hyperinsulinemia's potential to boost LDL production in the liver. Triglycerides and LDL cholesterol are also increased in peripheral tissues that are resistant to insulin's action on lipoprotein lipase [24–26]. In this study, most of the respondents experienced hyperglycemia and hypertriglyceridemia and this condition was different from the characteristics of previous studies.

4 Conclusion

This investigation shown that, regardless of gender, age, smoking habits, or clinical indications, there was no discernible relationship between IFN and blood glucose levels.

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