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Correlation Cholesterol and Triglyceride Level on Cognitive Function in Type 2 Diabetes Mellitus

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Abstract

Diabetes Mellitus (DM) is is still a public health problem both globally, regionally, nationally and locally. The prevalence of DM is 1.9% and makes DM the seventh cause of death in the world. One of the complications is a decrease in cognitive function. The triggers for cognitive function include high cholesterol and triglyceride levels. The purpose of this study was to determine the correlation between cholesterol and triglyceride leves on cognitive function in diabetes patients. This study is an analytic observational study .The subject are 51 respondents used purposive sampling technique. Chi-square test was found that there is a significant correlation between cholesterol and triglyseride level with cognitive function in type II diabetic patient.

Keywords*: cholesterol; triglycerides; cognitive function; diabetes mellitus type 2*

INTRODUCTION

Diabetes mellitus (DM) is a type of non-communicable disease that is still a public health problem, both globally, regionally, nationally and locally. It is one of metabolic disease that number continued to raise every year in countries around the world. Diabetes is a chronic metabolic disorder due to the pancreas dysfunction, causing an absolute or relative deficiency of insulin, resulting in an increase in the concentration of glucose in the blood (PERKENI, 2019).

Diabetes mellitus is known as a silent killer because patient often doesn't realize it and diagnosed when complications have been occurred (Kemenkes RI, 2014). The International Diabetes Federation (IDF) states that the prevalence of DM in the world is 1.9% and has made DM the seventh leading cause of death in the world, while in 2013 the incidence of diabetes in the world was 382 million people. The prevalence of type 2 DM cases is 85-90% among all diabetic population (Bustan, 2015).

The prevalence of DM in Indonesia in 2013 was 2.1%. This figure is higher than in 2007 1.1%. A total of 31 provinces (93.9%) showed a significant increase in the prevalence of diabetes mellitus (Dinkes, 2017). The prevalence for Central Java Province is 1.9%. The number of DM type 2 cases in Central Java in 2015 was 99,646

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cases. This is different from the previous three years. In 2014 cases of type 2 diabetes were 96,431 cases (0.29%).

In 2013 cases of type 2 diabetes mellitus in Central Java amounted to 142.925 (0,43%) cases, while in 2012 there were 181.543 (0,55%) cases (Kemenkes RI, 2014). The prevalence of type 2 DM in Surakarta in 2017 was 6,579 cases (Dinkes Surarakarta, 2017). According to data from the Surakarta Health Office, the number of DM type 2 cases in Surakarta has increased over the past 5 years.

Data from the Ministry of Health's data and information center shows that the prevalence of diabetes mellitus based on doctor's diagnosis for individuals > 15 years is 2 %. The data is reported to have increased from 1,5% from that reported in 2013. While the prevalence of diabetes based on the results of blood sugar examinations in 2018 was 8,5% compared to 6,9% in 2013 (Infodatin, 2018).

One of the complications that can be caused by DM is a decrease in cognitive function. Patients with type 2 diabetes experience impaired insulin resistance in target cells. This disturbance results in a decrease in the intake of blood sugar to cells throughout the body, resulting in metabolic disorders throughout the body, including the brain (Sato and Morishita 2015).

One of the effects of the decline in cognitive function is that the patient's social interactions with the community and family are reduced. According to Martin et al., (2014), changes in cognitive function influence intellectual function, reduced efficiency of nerve transmission in the brain (causing information processing to slow down and a lot of information is lost during this transmission), reduced ability to accumulate new information and retrieve information from memory, and the ability to remember past events is better than the ability to remember recent events.

Several studies have shown that dyslipidemia is one of the determinants that contribute to decreased cognition. DM and dyslipidemia are both risk factors for cardiovascular and cereberovascular disease. Excess blood sugar levels in the long term will result in prolonged oxidation and damage to the blood vessels in the body, including in the brain. Fat in dyslipidemia can accumulate in the blood vessels. This excess fat accumulation can develop into atherosclerosis, causing disruption of the blood vessels in the brain, stroke, or Transient ischemic attack (Libby, 2012). The damage caused by these two conditions can result in excessive damage to the blood vessels in the brain which is thought to be related to the cognitive function of DM patients who experience dislipidemia.

Apart from dyslipidemia, triglyceride levels also affect diabetes mellitus. Triglyceride levels will increase when you gain weight and consume foods with high sugar levels. In certain circumstances, such as Diabetes Mellitus, triglyceride levels will increase which is called Hypertriglyceridemia (Suzuki, 2010).

Research conducted by Ekawati in 2012, it shows that 20 diabetes mellitus patients have increased triglyceride levels more than normal values. Patients with triglyceride levels ≥ 200 mg / dl are 30% more likely to develop cerebrovascular

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disease . Based on the background description above, the researcher is interested in knowing correlation between cholesterol and triglyseride levels and cognitive function in type 2 diabetes mellitus .

RESEARCH METHODS

This study is an analytic observational study with a *cross sectional* approach . The data were obtained from the laboratory exam are carried out directly on during subjects visit to hospital. This research was conducted at a hospital in the Boyolali city . The population in this study were all patients suffering from Type 2 Diabetes Mellitus at who were visited to hospital in December 2019. The sample in this study were 51 respondents, who were determined by *purposive sampling technique* , which is a sampling technique based on a consideration, made by the researchers themselves based on the characteristics of the population that have been previously determined . The data analysis technique is using the *chi-square* test . This research has received approval from the Health Research Ethics Commission of the Faculty of Medicine, UMS with the number 2484/B.1/KEPK-FKUMS/XI/2019.

RESULTS AND DISCUSSION

Based on table 1, it is known that the description of respondents based on age, gender, cholesterol level, triglyseride level and cognitive function : the majority of respondents aged between 36-45 years were 41 (80.4%), female as many as 39 (76.5%) with majority had normal cholesterol levels 31 (60.8%), the majority of respondents had abnormal triglyceride levels were 27 (52.9%) and 30 (58.8%).respondents had impaired cognitive function.

Table 1. Description of the demographic data

	Category	Frequency	Percentage
Age	36-45 years	41	80.4
	46-55 years	10	19.6
Gender	Man	12	23.5
	Women	39	76.5
Cholesterol	Normal	31	60.8
	Abnormal	20	39.2
Triglycerides	Normal	24	47.1
	Abnormal	27	52.9
Cognitive Function	Normal	21	41.2
	Abnormal	30	58.8

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Bivariate Analysis

Based on the results of the *chi-square* test , the p-value is 0.003 <0.05, so it can be concluded that there is a significant correlation between cholesterol levels and cognitive function in type 2 diabetes mellitus .

Table 2. *Chi-square* results of cholesterol levels on cognitive function in type 2 diabetes mellitus

Variable		Cognitive function				Total	p-value
		Normal	%	Abnormal	%		
Cholesterol Levels	Normal	18	58.1	13	41.9	31	0.003
	Abnormal	3	15	17	85	20	
Total		21	41.2	30	58.8	51	

Based on the results of the *chi-square* test , the p-value was 0.000 <0.05, so it can be concluded that there is a significant correlation between triglyceride levels and cognitive function in type 2 diabetes mellitus

Table 3. C*hi-square* results of triglyceride levels on cognitive function in type 2 diabetes mellitus

Variable		Cognitive function				Total	p-value
		Normal	%	Abnormal	%		
Triglyceride levels	Normal	17	70.8	7	29.2	24	0.000
	Abnormal	4	14.8	23	85.2	27	
Total		21	41.2	30	58.8	51	

Multivariate Analysis

Based on the results of the logistic regression test, it was found that:

The OR (exp. B) cholesterol level was 6,908 with a minimum CI (95%) value of 1,349 and a maximum CI value (95%) of 35,371, so that respondents who had high cholesterol levels had a risk of impaired cognitive function by 6,908 times compared to respondents whose cholesterol levels are normal, with the lowest risk of 1.349 and the highest risk of 35,371.

The OR (exp. B) triglyceride level is 12,752 with a minimum CI (95%) value of 2,880 and a maximum CI (95%) value of 54,463, so that respondents who have high triglyceride levels have a risk of 12,752 with the lowest risk of 2,880 and risk. the highest was 54,463.

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Table 4. Multivariate results of cholesterol and triglyceride levels on cognitive function in type 2 diabetes mellitus

Variable	B	OR (exp.B)	95% CI		p-value
			Min	Max	
Cholesterol Levels	1,933	6,908	1,349	35,371	0.020
Triglyceride levels	2,546	12,752	2,880	56,463	0.001
Constant	-1,481	0.227			0.009

Relationship between cholesterol levels and cognitive function in type 2 diabetes mellitus

Based on the results, it was found that there was a significant relationship between cholesterol levels and cognitive function in type 2 diabetes mellitus. The results of calculations using the *chi-square* showed that the *p-value* was 0.000 <0.05. The results showed that there were 21 patients with normal cognitive function and all of them with normal cholesterol levels and 30 respondents with abnormal cognitive function , consisting of 7 respondents with normal cholesterol levels and 23 respondents with abnormal cholesterol levels.

In accordance with the results of research conducted by Yin et al., (2012) with the results that there is a significant relationship between HDL cholesterol levels and a decrease in cognitive function. According to Sato & Morishita (2015), changes in cholesterol balance can cause neurodegeneration which will affect brain function. Another theory also states that low cholesterol levels can have an impact on the lack of myelination process of nerve cells and can cause demyelin ation and disturbances in memory . Low cholesterol levels may also co-exist with chronic disease, poor intake or absorption of nutrients, and the presence of malignancy, which in turn can be associated with poorer cognitive performance. Low serum cholesterol and decreased cognitive function may be related because nerve cells require total cholesterol for normal metabolic processes (Ekoe et al., 2005). This explanation has been used previously to explain the results of studies in which total cholesterol is associated with better cognitive performance (Chrichton *et al* , 2016).

LDL cholesterol functions to carry cholesterol from the liver into cells. If this cholesterol level is high, it can lead to accumulation of cholesterol in the cells which can lead to hardening of the artery walls which is called atherosclerosis. Meanwhile, HDL cholesterol has the opposite work to LDL cholesterol, which is to carry cholesterol from cells to the liver. Low HDL levels actually have an adverse effect, triggering the formation of plaque on the walls of arteries so that it blocks brain blood flow and causes the death of brain cells.

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Relationship between triglyceride levels and cognitive function in type 2 diabetes mellitus

Based on the results, it was found that there was a significant relationship between triglyceride levels and cognitive function in type 2 diabetes mellitus. The results of the calculation using the *chi-square* showed a *p-value* of 0.000 <0.05. The results showed that there were 21 patients with normal cognitive function and all of them with normal cholesterol levels and 30 respondents who had abnormal cognitive function, consisting of 5 respondents whose cholesterol levels were normal and 25 respondents whose cholesterol levels were abnormal. In accordance with the results of research conducted by Sufitria (2016) that hypertriglycerides have a significant relationship with impaired cognitive function, with the chi-square results obtained a p-value of 0.030 <0.05

CONCLUSION

There is significant relationship between cholesterol on cognitive function in Type 2 diabetes mellitus , with a p-value of <0.05. There is a significant relationship between triglyceride on cognitive function in Type 2 diabetes mellitus, with a p-value of <0.05.

REFERENCES

Bustan. (2015). Manajemen pengendalian penyakit tidak menular. Jakarta. Rineka Cipta.

Crichton, G.E., Sullivan, K.J., Elias, M.F. (2016). Cholesterol and cognitive function in person free from stroke and dementia. In: Watson, R.R., and Meester, F.M., editors. Handbook of Cholesterol, 37-52.

Dahlan, Sopiyudin M. (2013). Besar Sampel dan Cara Pengambilan Sampel. Jakarta: Salemba Medika

Depkes RI. (2014). Waspada Diabetes Eat well live well. Situasi dan Analisis Diabetes, Jakarta.

.

Dinas Kesehatan Kota Surakarta. (2017). Profil Kesehatan Kota Surakarta. Surakarta.

Ekawati, ER. (2012). Hubungan Kadar Glukosa Darah Terhadap Hypertriglycerida Pada Penderita Diabetes Mellitus. Prosiding Seminar Nasional Kimia Unesa 2012-ISBN:978-979-028-550 7

Ekoe, J. M., Zubin Punthakee MD, MSc, FRCPC, Thomas Ransom MD, MSc, FRCPC, Ally P. H.Prebtani BScPhm, MD, FRCPC, Ronald Goldenberg MD, FRCPC, FACE. (2013). Retrieved from www.canadianjournalofdiabetes.com. Screening for Type 1 and Type 2, Canadian Journal of Diabetes, Volume 37 : S12-S15.

ISSN 2685-8673 (online)

INFODATIN. (2018). Pusat Data dan Informasi Kementrian Kesehatan Republik Indonesia. ISSN 2442-7659.

Libby, P. (2012). The Pathogenesis, Prevention, and Treatment of Atherosclerosis. Dalam Longo, et al, penyunting. Harrison's Principles of Internal Medicine 18th. Edisi ke-18. New York: The McGraw-Hill Companies, hlm 1983-97

Martín, Mauricio G et al. (2014). Choles terol in brain disea se: somet imes determ inant and frequ ently impli cated. EMBO reports, Vol 15, No 10

PERKENI. (2019). Pedoman Pengelolaan dan Pencegahan Diabetes Mellitus Tipe 2 Dewasa di Indonesia. PB PERKENI

Sato, N. and Morishita, R. (2015). The roles of lipid and glucose metabolism in modulation of β-amyloid, tau, and neurodegeneration in the pathogenesis of Alzheimer disease. Aging Neuroscience.

Sufitria, Afriatin. (2016). Hubungan Hipertrigliseridemia Dengan Gangguan Kognitif Pada Pasien Stroke Di Unit Stroke RSUP dr. Sardjito. Skripsi. Fakultas Kedokteran UGM.

Suzuki, Ryo et al. (2010). Diabetes and Insulin Regulation Of Brain Cholesterol Metabolism. Cell Metab. 2010 December 1; 12(6): 567–579. doi:10.1016/j.cmet.2010.11.006.

Yin, Z., Shi, X., Kraus, V.B., Fitxgerald, S.M., Qian, H., Xu, J.W. (2012). High Normal Plasma Triglyserides are associated with preserved cognitive function in Chinese oldest old. Age and Ageing. 1-7.

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