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The Control of Diabetes Mellitus in Coastal Communities in Surabaya Region

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Article Info

Abstract

Prevention of complications of diabetes mellitus requires good control of diabetes mellitus. Based on Basic Health Research Data of the Ministry of Health, in the end of 2013, the number of diabetic patients in Indonesia had reached 9.1 million and this number continues to grow which in 2030, the number is predicted to reach 21.3 million. This study aimed to identify the paramaters of diabetes mellitus control. This descriptive study involved 30 diabetic patients in coastal communities of Surabaya who were randomly selected. Data collection was undertaken using an observation sheet and diabetes control measurement tools. The data were analyzed descriptively. The results showed that diabetes control were mostly poor based from the indicator of fasting blood glucose level (181.77 ± 68.728) and two hours postprandial blood glucose level (277.07 ± 111.884). Meanwhile, total cholesterol (196.43 ± 60.640), blood pressure (systolic 125 ± 16.969 and diastolic 78 ± 8.469), and Body Mass Index ($23,257\pm3,231$) were good. Education on Self Care Management will support the control of diabetes mellitus.

Introduction

According to American Diabetes Association 2005, Diabetes Mellitus (DM) is a group of metabolic diseases which is characterized by hyperglycemic condition due to disorder in insulin secretion, insulin action, or both (Soegondo, Soewondo, & Subekti, 2015). Based on 2011 recommendation from Perkeni (Indonesian Endocrinology Association), a good DM control is necessary in order to prevent chronic complication of DM. The disease is adequately controllable when the blood glucose achieve its expected concentration. The end goal of Diabetes Mellitus management is decrease in DM-caused morbidity and mortality. Control of blood glucose, blood pressure, body weight, and lipid profile is necessary in order to achieve that goal.

In people from the coastal region of Suabaya, Type 2 DM is more commonly found compared to Type 1 DM. In working area of Tambak Wedi Public Health Center (PHC), many patients are undiscipline in their self management of diabetes, namely non-compliance in medication administration, blood glucose monitoring, diet, and lack of exercise because of their lack in knowledge regarding management of Diabetes Mellitus.

Accroding to 2016 data from World Health Organization, prevalence of diabetic patient is increasing all over the world. In 2014, 422 million adult people (8.5% of the population) had diabetes, compared to 108 million (4.7%) in 1980 (*World Health Organization*, 2016). Data from 2013 Basic Health Research (Riskesdas) from Ministry of Health showed that in 2013,

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the number of diabetic population in Indonesia was 9.1 million and the number was increasing. In 2030, the number is predicted to be 21.3 million (Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI, 2013). Data from 2018 Riskesdas showed that the prevalence of Non-communicable Diseases were increasing compared the data from 2013 Riskesdas, namely for cancer, stroke, chronic kidney disease, diabetes mellitus, and hypertension. Based from blood glucose test, the prevalence of diabetes mellitus was increased from 6.9% to 8.5% and based from blood pressure measurement, the prevalence of hypertension was increased from 25.8% to 34.1%. Those data showed that the management of diabetes was still indaquate.

In 2014, the number of diabetic patient in coastal region, particularly in Tambak Wedi PHC, Surabaya, was 1693 and the number of type 2 DM patient in December 2014 was 45 (65%). In 2014-2015, the number of diabetic patient was 1205 with 1112 (92%) of them had type 2 DM, while in 2015-2016 the number of diabetic patient was increased to 1397 with 1248 (89%) of them had type 2 DM. The result of interviews towards 10 type 2 DM found that 80% of them did not know about DM management. This problem together with inadequate education by PHC healthcare personnel became problems which caused uncontrolled diabetes.

Diabetes mellitus is caused by high level of blood glucose which is accompanied by metabolic disorder. Insulin is a hormone which is excreted by the pancreas and is the main substance which is responsible to maintain balanced blood glucose level in the body. Insulin functions as a tool to help glucose enter the cells, therefore it could produce energy or is saved as energy reserve (Mahdiana, 2010, in Marwan, Ratianingsih & Jaya, 2016). In type 2 DM, pancreas still produce Insulin, however the quality is poor and it cannot function properly as key to move glucose into the cells, therefore the blood glucose level is increasing. Diabetic Self-management Education (DMSE) is a process of health education to diabetic patients regarding application of self-employed self management strategy in order to optimize metabolic control, prevent complication, and improve patient's quality of life (Fan & Sidani,

2009).

The result of Diabetes Control and Complication Trial (DCCT) showed that a good control of diabetes mellitus could reduce its chronic complication by 20% to 30%. If it was ignored, complication of Diabetes Mellitus could happen in multiple organ and led to damage, dysfunction, and failure of many organs, especially eye, kidney, heart, nerve, and blood vessels (Putri & Isfandiari, 2013). Therefore, the main thing which is needed is management of Diabetes Mellitus through 4 pillars of diabetes mellitus management, namely education, diet regulation, exercise, and medication compliance (PERKENI, 2011). Education have important role because diabetic patient who received Diebetes Self Management Education (DSME) could experience improvement in metabolic control, quality of life, and decrease in complication. DSME also proved to have positive effect in increasing self-confidence and change in self management behavior of type 2 DM patient (Fan & Sidani, 2009; Rondhianto, 2011, in Yuanita, Wantiyah, & Susanto, 2014) such as diabetic ulcers. Diabetes Self Management Education (DSME. A study in Diabetes Mellitus management in community is needed in order to understand the extent of people's knowledge in caring for themselves to minimize risk of complication. Diabetes must be treated because it could cause numerous severe complication which could be fatal such as heart disease, kidney disorder, blindness, foot gangrene which could end in amputation, and impotence. Several parameters in diabetes mellitus management are fasting blood glucose, 2 hour post prandial blood glucose, HbA1c, cholesterol level, body mass index, and blood pressure. Nurse, as caregiver and educator, is expected to provide nurse care and education to the people regarding management of diabetes mellitus through Diabetes Self Management.

Methods

This was a descriptive study which describe several variables in diabetes mellitus control, namely fasting blood glucose, 2 hour post prandial blood glucose, total cholesterol level, body mass index, and blood pressure in people from Surabaya coastal area. The research population were 43 patients with type 2 DM, particularly in Tambak Wedi

PHC working area. The number of sample was 30. They were chosen through simple random sampling from type 2 DM patients in Tambak Wedi PHC working area who fulfilled the following criteria: age 30 to 60 years old, minimum education level of elementary school, and did not have diabetic complication such as diabetic ulcer, chronic kidney disease, heart failure, etc. The data were acquired in March 2017 through several instruments, namely demographic data questionnaire, observation sheet, blood glucose test device, cholesterol and uric acid measurement device, body height and body weight measurement device, sphygmomanometer, and stethoscope. The data were analyzed descriptively according to diabetes mellitus control criteria based from 2006 consensus of Perkeni, namely good, moderate, and poor.

Results and Discussion

The study was conducted in 30 DM patients in Tambak Wedi PHC working area. Most of the subjects were female (90%), age 51-60 years old (60%), educated in elementary school level (56.7%), unemployed/housewives (63.3%), and related to family member with DM (43.3%). Most of the subjects had diabetes for 1-5 years (73.3%). In relation to diabetes

Table 1. Characteristics of diabetes mellitus patients in Tambak Wedi PHC, Surabaya working area on 10-25 March 2017 (n=30

No	Characteristics of respondents		Frequency	
			Number	%
1	Gender	Male	3	10.0%
		Female	27	90.0%
2	Age	41 - 50 years	12	40.0%
		51 - 60 years	18	60.0%
3	Education level	Elementary school	17	56.7%
		Junior high school	4	13.3%
		Senior high school	8	26.7%
		University	1	3.3%
4	Marital status	Married	25	83.3%
		Divorced	5	16.7%
5	Occupation	Unemployed/housewife	19	63.3%
		Private sector	4	13.3%
		Private enterprise	5	16.7%
		Fisherman	1	3.3%
		Retired worker	1	3.3%
6	House occupant	Spouse	2	6.7%
		Spouse and children	24	80.0%
		Children or grandchildren	4	13.3%
7	History of disease in the family	Diabetes melitus	13	43.3%
		Kidney disease	1	3.3%
		Lung disease	1	3.3%
		Hypertension	4	13.3%
		Asthma	1	3.3%
		None	8	26.7%
		Others	2	6.7%

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8	Previous history of disease	Diabetes mellitus	20	66.7%
		Lung disease	1	3.3%
		Hypertension	4	13.3%
		Cardiac disease	1	3.3%
		Rheumatic disease	1	3.3%
		None	2	6.7%
		Others	1	3.3%
9	Physical activity	Gymnastic	12	40.0%
		Morning run	2	6.7%
		Walking for 1-2 km	7	23.3%
		None	9	30.0%
10	Frequency of physical activity	Everyday	7	23.3%
		Once a week	14	46.7%
		Never	9	30.0%
11	Foot exercise	Never	20	66.7%
		Occasionally	1	3.3%
		Routine	9	30.0%
12	Foot care	Never	22	73.3%
		Occasionally	3	10.0%
		Routine	5	16.7%
13	Medical visit	Never	3	10.0%
		Occasionally	10	33.3%
		Routine	17	56.7%
14	Routine care facility	Hospital	7	23.3%
		Public health center	18	60.0%
		Clinics	3	10.0%
		Pharmacy	2	6.7%
15	Diabetes club attendance	Attend diabetes club	1	3.3%
		No	29	96.7%
16	Diabetes care education	Receive diabetes care education	15	50.0%
		No	15	50.0%
17	Insulin usage	Use insulin	4	13.3%
		No	26	86.7%
18	Smoking	Smoke	0	0.0%
		No	30	100.0%
19	Regular meal	Receive regular meal	28	93.3%
		No	2	6.7%

20	Favourite meal	Meatball	2	6.7%
		"Soto" soup	3	10.0%
		Fish	8	26.7%
		Vegetable	7	23.3%
		Fruit	3	10.0%
		Others	7	23.3%
21	Favourite beverage	Plain water	25	83.3%
		Tea	4	13.3%
		Coffee	1	3.3%
22	Oral antidiabetic drugs consumption	Yes	30	100.0%
		No	0	0%
23	Duration of disease	1-5 years	22	73.3%
		6-10 years	3	10.0%
		11-15 years	3	10.0%
		16-20 years	2	6.7%

management, most of the subjects (70%) performed exercise, such as gymnastic, jogging, and walking, had average frequency of physical exercise was once a week (46.7%), never performed foot exercise (66.7%), and never performed specific foot care (73.3%). Most of the subjects routinely visit healthcare facilities (56.7%), however, most of them did not join diabetes mellitus club (96.7%). Characteristics of the respondents can be seen in Table 1.

This study found that among 30 respondents, most of them had poor diabetes control based from fasting blood glucose (181.77$\pm$68.728) and 2 hours post prandial blood glucose (277.07$\pm$111.884), with percentage of 70% and 76.7%, respectively. Meanwhile, based from total cholesterol level (196.43$\pm$60.640), body mass index (23.257$\pm$3.2315), and blood pressure (systolic of 125$\pm$16.969 and diastolic of 78$\pm$8.469) most of the respondents had good diabetes control with percentage of 60%, 43.3%, and 70%, respectively.

Diabetes mellitus is a collection of symptoms which occurs in individual with high level of blood glucose (hyperglycemia) because the body has absolute or relative insulin deficiency. The objectives of type 2 diabetes management are to prevent or postpone complication and maintain good quality of life. These need glycemic control and cardiovascular risk factors management, regular follow up, and most importantly, patient-centered approach in order to increase patient involvement in self care activities (Davies, D'Alessio, Fradkin, Kernan, Mathieu, et. al., 2018). Recommendation of Perkeni in 2011 stated that good DM control is needed in order to prevent occurrence of chronic complication. Diabetes is said to be good controlled when blood glucose level achieve expected level. Control criteria are based on measurement of blood glucose level, HbA1c level, and lipid profile. Definition of a good diabetic control is when blood glucose, lipid, and HbA1c levels achieve expected level, and nutritional status and blood pressure achieve determined targets (PERKENI, 2011). This study found that from 30 subjects, most of them (70%) had poor diabetic control based on fasting blood glucose (181.77$\pm$68.728) and 76.7% of them had poor diabetic control based on 2 hours post prandial blood glucose level (277.07$\pm$111.884). This finding could be explained because diabetes mellitus control is always related to individual efforts in self management both in preventive or curative measures. This is in accordance with a finding by Depkes RI (2008) which stated that preventive measures are conducted towards healthy individual or groups or person who has not acquire DM in order to remain healthy,

Table 2. Characteristics of diabetes mellitus control in patients in Tambak Wedi PHC, Surabaya on 10-25 March 2017 (n=30)

Diabetes Melitus Control		Number	%	Mean±SD
Fasting blood glucose	Good (80-109 mg/dl)	3	10.0%	181.77±68.728
	Moderate (110-125 mg/dl)	6	20.0%	
	Poor (> 126 mg/dl)	21	70.0%	
2 hours post prandial blood glucose	Good (110-140 mg/dl)	5	16.7%	277.07±111.884
	Moderate (145-179 mg/dl)	2	6.7%	
	Poor (> 180 mg/dl)	23	76.7%	
Total cholesterol	Good (<200 mg/dl)	18	60.0%	196.43±60.640
	Moderate (200-239 mg/dl)	4	13.3%	
	Poor (>240 mg/dl)	8	26.7%	
Body mass index	Good (18.5-22.9 kg/m^2)	13	43.3%	23.257±3.2315
	Moderate (23-25 kg/m^2)	11	36.7%	
	Poor (>25 kg/m^2)	6	20.0%	
Blood pressure	Good (<130/80 mmHg)	21	70.0%	125±16.969 78±8.469
	Moderate (130-140/80-90 mmHg)	5	16.7%	
	Poor (>140/90 mmHg)	4	13.3%	

Source: Primary data

while curative measures are conducted towards person or group who possess DM or its risk factors and are maintained to remain healthy or normal. A study by Anani, Udiyono, & Ginanjar (2012) in 77 DM outpatients found that there was a correlation between blood glucose and medication usage habit (p=0.032), physical activity (p=0.012), sport activity (p=0.041), and dietary habit (p=0.001). Ilyas (2011, in Soegondo et al., 2015) stated that glucose absorption by resting body tissue needed insulin, while in active muscle, it did not associated with increase in insulin level, although glucose requirement was increased. This was because there was an increase in insulin receptor sensitivity in active muscle during physical activity. The main problem which occurred in type 2 diabetes mellitus is insulin resistance which makes glucose could not enter into the cells. When someone perform physical acitivity, there will be muscle contractions which facilitate glucose entrance into the cells. This means that physical activity could decrease insulin resistance and eventually decrease blood glucose level. During physical acitivity, insulin resistance is decreased and conversely, insulin sensitivity is increased which eventually decreases insulin requirement in type 2 diabetic patients. This response only occurs during exercise and is not a permanent or long lasting effect, therefore, exercise has to be done continuously and regularly. Fauzi (2013) found that walking with moderate and high intensity were both significant in decreasing blood glucose level in DM patients. Administration of moderate and high intensity walking intervention was in accordance with 2016 American Diabetes Association (ADA) recommendation. ADA stated that in order to increase blood glucose control, maintain ideal bodyweight, and decrease cardiovascular disease risk, two type of walking physical exercise program could be performed. We assume that beside antidiabetic drugs, blood glucose level was influenced by patient's ability in performing self management, patient's compliance in performing physical activity and exercise, and diet compliance.

Internal factors which could affect blood

glucose level measurement were (Qurratuaeni, 2010): 1) Disease and stress: Stress stimulates counter-insulin hormones (hormones which counter the effect of insulin) to be more active, therefore blood glucose will increase; 2) Obesity: Obestity can decrease the number and sensitivity of insulin receptors in target cells in the body, therefore insulin cannot be used; 3) Nutrition intake: Different meals can give different effect on blood glucose level; 4) Physical activity: Exercise or physical activity can maintain body weight and burns blood glucose into energy; 5) Medication, both through oral hypoglycemic drug or insulin: Most of oral hypoglycemic drugs work by stimulating beta pancreas cells to secrete insulin or decreasing glucose absorption in the gut, therefore decreasing blood glucose level; 6) Duration of DM: The longer the patients suffer from DM, the blood vessels will be thicker and harder because of lipid accumulation. External factors which affect blood glucose level are 1) Education: It is correlated with patient's behavior in performing blood glucose level control in order to be stable; 2) Knowledge: DM patient will be able to control their blood glucose when they have adequate knowledge regarding dibates mellitus and its signs, symptoms, and management; 3) Proximity and exposure to the source of information: In DM patients, easiness in acquiring information regarding blood glucose level control will facilitate their action in maintaining their blood glucose level.

The results of this study showed that among 21 subjects with poor fasting blood glucose level, 14 subjects (66.7%) had diabetes for 1-5 years and almost all of them (95.2%) did not join DM club. Similarly, among 23 subjects with poor 2 hours post prandial blood glucose level, 16 subjects (69.6%) had diabetes for 1-5 years and almost all of them (95.2%) did not join DM club. This finding could be explained because several possible causes of poor diabetes mellitus control based on blood glucose level indicator are patient's distressful condition and lack of knowledge regarding diabetes care. Coastal populations usually have high density level and are releuctant to join diabetes club, they prefer to perform their daily job. We assume that DM clubs are places for DM patients to understand signs, symptoms,

possible complications, and management of DM. Lack of knowledge regarding diabetes care can cause inadequate control of blood glucose level and also can cause distress condition which eventually results in increase of blood glucose level. Diabetic distress condition was significantly related to A1C and physical activity (Fisher, Glasgow, & Strycker, 2010). Stress stimulates stress hormones such as cortisol, adrenalin, or growth hormone, in which all of them act against insulin, therefore increasing blood glucose level. Psychological stress in diabetic patient need to be managed. Maghfirah, Sudiana, & Widyawati (2015) proved that progressive muscle relaxation once daily before breakfast in the morning for 25 minutes and consecutively for 6 days could decrease psychological stress in type 2 diabetes mellitus patients. In our opinion, stress management need to be done in an effort to help control blood glucose level.

This study also found that among 30 subjects, most of them (60%) had good diabetic control based on total cholesterol indicator (196.43$\pm$60.640). Factor which affect total cholesterol level is frequency of physical activity. Exercise intensity also affects change in blood lipid profile. The higher the exercise intensity, the possibility to decrease cholesterol level will be increase, therefore, the risk of coronary heart disease will be decrease. A study which involved 32 people found a decrease in average cholesterol level in subjects who perform gymnastic physical activity three times a week for 30 minutes in each session (Suwarsi, 2017).

Most of Surabaya coastal area population in this study, particularly in Tambak Wedi PHC working area were female (90%) and 63.3% of them were housewive who were busy with daily household activities, including helping their husbands process their catches from sea, hence, most of the subjects could be regarded to have numerous activities. This study found that among 18 subjects who had good diabetic control based on cholesterol indicator, 72.2% of them routinely performed physical activity everyday or once a week. The most common physical activities were gymnastic, morning run, and walking for 1-2 km. Mann, Beedie, & Jimenez (2014) stated that physical activity and exercise could be used to improve cholesterol

level. Regular physical exercise had been proven to increase High Density Lipid (HDL) cholesterols while balancing the increase of Low Density Lipid (LDL) cholesterol and trigyceride. More intense activity was needed to decrease LDL chlesterol and triglyceride. High intensity aerobic exercise was effective in improving lipid profile and its effect was more prominent compared to regular physical exercise by starting to clean plasma LDL cholesterol and triglyceride. Increase in calory release related to aerobic exercise (through increase in intensity and/or duration) had been proven to positively affect activity of lipoprotein lipase, HDL cholesterol level, and lipid profile. In conjunction with above studies, Duvivier et al., (2013) found that physical exercise for 1 hour a day could not compensate negative effect of inactivity on insulin and plasma lipid level if the rest of the day was spent sitting. Reducing inactivity by increasing time spent on walking/standingwas more effective compared to one hour of physical acitivity when energy release was kept constant. In or opinion, physical activities which were performed by the subjects of this study was excellent in improving cholesterol level and lipid profile. Improvement in lipid profile could increase insulin sensitivity in diabetic patients, however, the physical acitivity had to be performed regularly everyday.

Diabetes is mainly determined by obesity and lifestyle factors such as diet and exercise (Hu et al, 2001 in Shai et al., 2006). The study found that 40% of diabetic patients had poor total cholesterol level (>200 mg/dL). ES, Decroli & Afriwardi (2018) stated that among 37 diabetic nephropathy patients, 94.6% of the experienced dyslipidemia. High level of lipid in blood could cause atherosclerosis which could affect renal artery, therefore decreasing glomerular filtration rate (GFR) and increasing the risk of diabetic nephropathy. A study by Tsalissavrina, Wahono, & Handayani (2006) found that both high fat diet and high carbohydrate diet could increase blood triglyceride level in experimental animals. Tsalissavrina et al. explained that increase in energy intake or lipid from high fat diet group would increase lipogenesis activity which increase the production of free fatty acid (FFA). High carbohydrate diet would increase glycolysis reaction which increase the conversion of glucose to fatty acid. This free fatty acid combined with glycerol to become triacylglycerol (TG). In our opinion, diet control is very important for diabetic patient, particularly in coastal population which usually are low income household with high density community and lack of knowledge and understanding regarding diabetes.Therefore, healthcare personnels need to provide education.

This study also found that most of the subjects (43.3%) had good diabetic control based on body mass index indicator (23.257$\pm$3.2315). 2006 PERKENI consensus (in Soegondo et al., 2015) classified the body mass index as good (18.5-22.9), moderate (23-35), and poor (>25). Factors which affect body mass index according to Rahmanisa & Wulandari (2016) were physical activity or exercise and basal metabolic rate or energy level which was required to maintain minimal function of the body. Basal metabolic rate is responsible for two thirds of energy release in person with normal body weight. Although physical activity is responsible for only one third of energy release in person with normal body weight, in obese people, the role of physical activity becomes more important. During exercise, calory will be burn, therefore more exercise will burn more calory. Calory is indirectly influence basal metabolic system. A person who only sit all day along will experience decrease in his/her basal metabolism. Lack of physical activity will cause an enormous cycle because obesity will make exercise becomes more difficult and less enjoyable and eventually, less exercise will indirectly decrease his/her basal metabolic rate.

This study also found that among 13 subjects with good diabetic control based on body mass index indicator, 9 subjects (69.3%) perform reguler physical activity once a week to everyday in the form of gymnastic exercise and walking for 1-2 km. This was in accordance with a study by Dewantari, Kayanaya & Melantini (2011) in 25 people which showed a decrease in body mass index in subjects who performed gymnastic exercise 3 to 5 times a week for 30 minutes in each session. We assume that physical activity has important role in decreasing body mass index because during

exercise, calory will be burned, therefore more exercise would lead to more calory burning.

Other factors which can cause poor diabetic control based on body mass index is duration of diabetes. A study by Pardede, Rosdiana, & Christianto (2017) in 51 diabetic outpatients in Internal Medicine Clinic of Arifin Achmad Hospital, Pekanbaru, showed that 35 subjects (68.6%) could not achieve diabetes control target for body mass index parameter (<18.5 Kg/m^2 $\geq$ 23 Kg/m^2) while 16 respondents (31.4%) successfully achieved the diabetes control target based on body mass index parameters (18.5 Kg/m^2 - <23 Kg/m^2). Pardede et al. (2017) stated that among 16 subjects, 50% of them had diabetes for >10 years, while from 35 subjects, 74.3% of them had diabetes for<10 years. We assume that the condition is caused by progression of diabetes which release patient's energy reserve, but the results cannot be utilized by the cells because decrease in insulin sensitivity lead to decrease in blood glucose intake into the body, therefore causes the patient to become weak, decrease patient's body function, and decrease patient's body weight.

Previous study explained the correlation between body mass index (BMI) and prognosis of diabetes. A study by Costanzo et al. (2015) in 10568 diabetic patient for average 10.6 years showed that patients who were overweight or obese (BMI>25 kg/m^2) had higher prevalence of cardiac disease (such as acute coronary syndrome and heart failure) compared to patients with normal BMI (18.5 to 24.9 kg/m^2). However, overweight condition (BMI of 25 to 29.9 kg/m^2) was correlated with lower risk of death, while obese patients (BMI >30 kg/m^2) had similar risk of death with patients who had normal body weight. Patients with the lowest body weight had the worst prognosis. We asssumed that education regarding diabetes self management which includes diet regulation, physical exercise, and oral hypoglcyemic drug need to be given so the patients could control their disease.

Uncontrollable type 2 diabetes mellitus could lead to numerous chronic complications, both in the form of microangiopathy (such as retinopathy and nephropathy) or macroangiopathy (such as coronary heart disease, stroke, and peripheral vascular diseases). Pathophysiology of coronaryheart diseases (CHD) in type 2 DM is complex and correlated with atherosclerosis which is affected by several factors, namely hypertension, hyperglycemia, dyslipidemia, smoking, family history of CHD, and obesity (Waspadji, in Yuliani, Oenzil, & Iryani (2014). This study found that most of the subjects (70%) had good diabetic control based from blood pressure indicator (systolic of 125 ± 16.969 and diastolic of 78 ± 8.469). This could be explained because diabetic patients in coastal area had low consumption of fish (26.7%) and high consumption of plain water (81%) compared to tea or coffee. Among 21 subjects who had good blood pressure ($<130/80$), 15 subjects (71.4%) had diabetes for 1-5 years. This could enable the occurrence of atherosclerosis because of minimum layer of glucose in blood vessel wall. A study by Yuliani, Oenzil, & Iryani (2014) in 176 DM patients with and without CHD showed significant relationship between duration of DM, hypertension, obesity, and prevalence of CHD in type 2 DM patients. Glucotoxicity can increase Renin Angiotensin Aldosteron System (RAAS) which will increase the risk of hypertension. Hypertension is accompanied by oxidative stress and the activity of radical oxygen species can mediate blood vessel wall damage because of activation of angiotensi II, therefore worsening endothelial dysfunction and increasing the risk of CHD. When the patients has comorbidity between hypertension and DM, the risk of cardiovascular disease becomes twice. A study by Poanta, Porojan, & Dumitrascu (2011) found differences in heart beat of diabetic patients compared to healthy people. Cardiac autonomic neuropathy was correlated with left ventricular diastolic dysfunction (LVDD) in type 2 DM patients although without clinical manifestation of cardiac diseases. Patients with uncontrolled DM had 2.514 times more risk to experience destruction of periodontal tissue (loose tooth and tooth loss) compared to patients with controlled DM (Rikawarastuti, Anggreni, Ngatemi, 2015). We assume that given the high probability of vascular disorder in diabetic patients, therefore, blood pressure as one important indicator of diabetic control need to

be adequately controlled.

Other factor which can affect blood pressure is physical activity. Lack of physical activity would increas the risk of hypertension due to higher risk of obesity. People with low level of physical activity tend to have higher heart rate therefore their cardiac muscle need to work harder in each contraction. When cardiac muscle pump harder and more frequent, pressure which is given to artery will be larger (Anggara & Prayitno, 2013). This study found that among 21 subjects with good blood pressure (<130/80 mmHg), 14 subjects (66.7%) regularly performed physical activity for once a week to everyday in the form of gymnastic exercise, morning run, and walking for 1-2 km. We assume that diabetic control based on blood pressure indicator tend to have good results because the majority of the patients only had diabetes for 1-5 years, routinely performed physical acitivity, and consumed healthy meals and beverages.

Diabetes mellitus patients who were given intervention in the form of a mobile and web-based self–management patient coaching system experienced decrease in average glycated hemoglobin (HbA1c) during 1 year treatment period. Patients received education and behavior message automatically and real-time as response to blood glucose level, diabetic medication, and lifestyle which were communicated individually through cellphone. The provider received reports every three months which summarize patient's glycemic control, diabetes medication management, lifestyle, and evidence-based treatment option (Quinn et al., 2011). We assume that that study proved diabetic patient coaching system in managing diabetes could be performed through cellular phone and web, because both system could reach vast area, including coastal area. Furthermore, almost every person had cellular phone which could be used every time. This could be utilized to transfer education regarding health aspects and patient's behavior coaching.

Diabetes mellitus control is a preventive measures towards an individual or group of people who is/are healthy or has/have not acquire DM in order to maintain their healthy condition and curative measures towards an individual or group of people who has/have risk factors or already acquire DM in order to maintain their healthy or normal condition. The criteria of DM control are based on several measurements such as blood glucose level, cholesterol level, body mass index, and blood pressure. This study showed that among 30 subjects, most of the subjects had poor diabetic control based on fasting blood glucose and 2 hours post prandial blood glucose. Meanwhile, most of the subjects had good diabetic control based on total cholesterol, body mass index, and blood pressure. Diabetic patients in Surabaya coastal region could control their disease by routinely perform physical acitivity, exercise, and diet restriction, therefore, reducing the risk of possible complication. Motivation and support from the family and health education from the nurse as educator in PHC could increase patient's ability in self management of their disease.

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