CONTRIBUTING FACTORS RELATED TO TYPE 2 DIABETES MELLITUS AMONG ELDERLY: RETROSPECTIVE COHORT STUDY IN LAMPUNG-INDONESIA

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ABSTRACT

Background: Type II Diabetes Mellitus is the most common non-communicable diseases among the elderly. Several modifiable and non-modifiable factors contributed to the occurrence of these diseases.
Purpose: Describing of the factors related to the occurrence of type 2 Diabetes Mellitus among the elderly at an integrated development post non- communicable diseases (*Posbindu PTM Way Halim*) Bandar Lampung-Indonesia.
Methods: The type of this research is quantitative, from database in the medical record with total of 74 by purposive random sampling. Data analyzed by univariate and bivariate (chi-squared).
Results: Smoker (p-value = 0.016; OR 3.429), physical activity (p-value = 0,000 ; OR 7.467) and waist circumference (p-value = 0.011 OR 4,091). Those were main factors that influence to the occurrence of DM among eldely.
Conclusion: It is suggested to management Public Health Services (Puskesmas) to establish a more integrated development post non- infectious diseases (Posbindu) to reach all the elderly. By controlling all of the factors that influence the occurrence of type II DM in various ways, so that the elderly will have a better life and prevent the complications

Keywords: Type 2 Diabetes Mellitus, Elderly, Integrated Development Post *(Posbindu)*

INTRODUCTION

Rates are one of the indicators used to measure the health status of the population. Morbidity classified as an indicator of health. The lower the number of morbidities, the better the degree of population health. The morbidity of the elderly population in 2014 is 25.05%. Of 100 older adults, 25 of them had an illness. When viewed from its development from 2005-2014, the health status of the elderly population has increased on health problems and seldom disrupt daily activities, but the occurrence of health complaints and types of claims experienced by residents can describe health levels/degrees roughly. Older adults suffer an increase marked by a decrease in morbidity in the elderly (Ministry of Health of the Republic of Indonesia, 2016).

Age, decreasing of physiological function, and the aging process increasing the risk of infectious diseases among the elderly. Furthermore, body resistance because degenerative problems lead to Non-Communicable Diseases (NCB), including hypertension, arthritis, stroke, Chronic Obstructive Lung Disease (COPD) and Mellitus DM (DM) (Ministry of Health of the Republic of Indonesia, 2016).

The primary cause for blindness, heart attack, stroke, kidney failure, and leg amputation in 2015 is Type II DM with the total number is 415 million and estimated in 2040 up to 642 million worldwide. The case of Type II DM in North America is 44.3 million, the West Pacific is 153.2 million and in the Asian region is 96 million with the mortality rate of 3.7 million. Type II DM was the seventh cause of death in the United States in 2015 based on 79,535 death certificates, (WHO, 2017). The three leading causes of death in Indonesia is Type II DM with 6.7% of total deaths and 7.6 million patient in Indonesia are affected by Type II DM. A total of 12.6 million patient are in pre-DM conditions (Ministry of Health of the Republic of Indonesia, 2017).

Several non-communicable diseases arise with the rise of age; physiological functions decline related to the aging process, degenerative problems due to body resistance; thus it is necessary to improve health services in the elderly. Non-Communicable Diseases (NCB) occur in elderly including hypertension, arthritis, stroke, Chronic Obstructive Pulmonary Disease (COPD) and Type II Diabetes Mellitus (Muhith & Siyoto, 2016).

The highest percentage of the elderly population is Yogyakarta (13.4%), and the lowest is Papua (2.8%) while in Lampung is 7.8% (Ministry of Health of the Republic of Indonesia, 2016). The total population of patient with ≥ 60 years in Lampung Province in 2015 was 637,05, and Central Lampung is area with the highest elderly population with 109,785, followed by East Lampung District with 95,214, Bandar Lampung City with 58,902, Pesawaran Regency with 35,708 (5.6%) elderly and the lowest was in West Pesisir was of 10,239 elderly (Public Health Agency, 2016).

Based on visitation record in 2015, of 33,478 elderly 10,581 (47.6%) visited *Posbindu* and in 2016 from 29,334 elderly of 7712 (26.3%) visited *Posbindu*, with the highest coverage in the Kedaton Health Center of 2,875 elderly, of 1,110 (38.6%) visited *Posbindu* while *Puskesmas* with the lowest coverage of elderly visits to *Posbindu* were at Way Halim Health Center from 3,113 elderly only 562 (18.7%) visited *Posbindu* (Bandar Lampung Health Services Authority, 2016).

The creating a healthy lifestyle, happy, efficient and productive old age for the elderly one of intervention is the establishment of *Posbindu*. This forum is Community-based Health Services (CBHS) to serve the elderly population, focusing on health services of promotive and preventive efforts. Posbindu provides social services, religion, education, skills, sports, cultural arts, and other services needed for the elderly to improve the quality of life through health and well-being. *Posbindu* helps the elderly to be able to engage in activities and develop their potential. Until 2015, the number of elderly groups that provided new promotive and preventive services spread in 23 provinces in Indonesia (Yuliana, Jumiati & Setiawati, 2016).

Elderly with Type II DM need to get appropriate care to control DM, well-managed health conditions and the best quality of life. The four pillars of DM management in Indonesia are education, food planning, physical activity, and pharmacological interventions, if the four components are appropriately applied, then the condition of the elderly with DM can be controlled. Although in fact in the elderly, this Type II DM accompanied by other diseases, physical disability, psychosocial disorders, cognitive function and an increase in the need for medical health services (Perkumpulan Endokrinologi Indonesia, 2011).

That factors related to DM mellitus in the elderly were hereditary history (p value = 0,000 <0,05 OR = 13,286), obesity (p value = 0,000 <0,05 OR = 11,200), diet (p value = 0,000 <0,05 OR = 11,200), lack of physical activity (p value = 0,000 <0.05 OR = 21,000) (Trisnawati, 2013). Showed that factors related to the occurrence of DM Type II were physical activity variables p value = 0,0005, Obesity p value = 0,027, and family history of DM p value = 0,0005 (Fransiska, 2015).

The resulting survey conducted on March 18-20, out of 10 diagnosed with DM, 4 (40%) had the family history of DM and 6 (60%) without a family history of DM, 80% of were smoking, and 20% not smoke, 60% of elderly obese, as 40% were average weight. The total of 80% said inactive, and 20 did regular exercise every week. Based on the problem data above the authors are interested in researching factors related to type 2 DM in the elderly in Wayhalim Village.

RESEARCH METHODS

The type of this research is a quantitative used secondary data from the medical record. The population in the study from October to December of 2017 was 281 patients registered in the *Posbindu*. The sample size in this study was calculated using the formula from Slovin in (Notoadmodjo, 2012). A total of 74 samples included in this study by using a purposive sampling technique.

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RESEARCH RESULTS

Table 1. Demographic Characteristics of Patients With Type II DM (N = 74)

Variables	Frequency	Percentage (%)
Family History		
Have a family history	42	56.8
Do not have a family history	32	43.2
Smoking		
Smokers or the past used cigarettes	30	40.5
Never smoking	44	59.5
Physical Activity		
Low	36	48.4
Moderate	38	51.6
Waist Circumference		
Greatly Increased Risk	26	35.1
Healthy Range	48	64.9

Based on table 1, elderly has a family history of DM was of 42 (56.8%) and without a family history of DM is 32 (43.2%). who smoke is 30 (40.5%) and who not smoke is 44 (59.5%). The total of 36 (48.6%) had lack physical activity and with the moderate/moderate physical is 38 (51.4%). who had greatly increased risk waist circumference is 26 (35.1%), and with Healthy Range are 48 (64.9%).

Table 2. Factors Associated With The Occurrence Of DM Among Elderly

Demographic Characteristics	DM	Control	*p-value*	OR
Family History				
Have a family history	21	21	0,007	4.333 (1.480-12.686)
Do not have a family history	6	26		
Smoking				
Smokers or the past used cigarettes	16	14	0.000**	7.467 (2.498 - 22.322)
Never smoking	11	33		
Physical Activity				
Low	21	15	0.000**	7.467 (2.498 - 22.322)
Moderate	6	36		
Waist Circumference				
Greatly Increased Risk	15	11	0.011**	12 (1.481-2711.299)
Healthy Range	12	36		

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Based on Table 2 it can be seen from 42 with a family history of DM, 21 (28.4%) of them had Type II DM and 21 (28.4%) without DM. Of 32 without Type II DM in family history, 6 (18.8%) of them diagnosed with DM and with 26 (35.1%) not diagnosed with Type II DM. Statistical test results obtained (*p-value* = 0.007 OR value of 4,333) thus there is a relationship between family history of DM and the occurrence of DM with a risk of DM 4 times greater than the who do not have a family history of DM. 30 elderly who smoker or the past used cigarettes, 16 (53.3%) had Type II DM and 14 (46.7%) without DM, of 44 elderly who never smoking, 11 (25.0%) of them had DM and 33 (75.0%) without DM. The results of statistical tests obtained *p-value* = 0.016 which means <α, it can be concluded that there is a relationship of smoking with the occurrence of DM. With a value of OR 3.429, therefore that who are smoker have a risk three times greater than who never smoking. 36 elderly who have less / low physical activity, 21 (58.3%) had DM and 15 (41.7%) not DM. Of the 38 who had sufficient/moderate physical activity, as 6 (15.8%) experienced DM and 32 (84.2%) did not DM. The results of statistical tests obtained *p-value* = 0,000 which means <α, it can be concluded that there is a relationship between physical activity and the occurrence of DM. With an OR value of 7,467, it means that who have less physical activity have a risk seven times more likely to develop DM when compared to who have sufficient/moderate physical activity. 26 with the risk of waist circumference risky, 15 (57.7%) s experienced DM and 11 (42.3%) did not DM. Of the 48 who had a waist circumference, not at risk, 12 (25.0%) experienced DM and 36 (75.0%) did not DM. The statistical test results obtained *p-value* = 0.011 which means <α, it can be concluded that there is a relationship of waist circumference with the occurrence of DM. With a value of OR 4,091, it means that with waist circumference are at risk of having four times greater risk of developing DM than who are have a normal waist circumference.

DISCUSSION

The normal blood sugar levels tend to increase mildly but progressively after the age of 50 years, especially in patient who are inactive. Insulin is a hormone released by the pancreas, the primary substance responsible for maintaining the right blood sugar levels. Insulin causes sugar to move into cells so that it can produce or stored as an energy reserve. The increase of blood sugar levels after consuming food stimulates the pancreas to produce insulin, preventing further increases in glucose levels and causing decrease slowly. At an additional time and cause blood sugar levels to reduce gradually, the glucose seed performs physical activity, blood sugar levels can also decrease because muscles use glucose for energy (Hapsari, 2008; Tandra, 2017).

The previous study showed that the variables that were risk factors to Type II DM were the frequency of family history distribution (22%), obesity (22%), physical activity (44%) and smoking habits (15%) (Dharmawijaya, 2013). Another research described the risk factors for diabetes mellitus in adults from 1313 patient, 46 (3.5%) of them had diabetes, and 242 (18.4%) had pre-diabetes, and the rest were normal (Sirait, 2015)

In the opinion of researchers, the high prevalence of DM in *Posbindu* in Way Halim Village and the dangers of DM disease, prevention, and prevention efforts should be urgently needed to deal with the disease. Mitigation efforts can be made by inviting patient affected by DM to always control blood sugar (regular checks) to *Posbindu* in Way Halim Village. Prevention efforts can be made by providing counseling or distributing leaflets to patient from adolescents, adults, and the elderly to adopt a healthy lifestyle. The use of brochures as a health promotion media has several advantages, namely: the user can see the contents when relaxed, can learn independently and information that usually shared with family and friends. Therefore, Lampung Health Office and Way halim Health Center can provide counseling to schools because prevention from adolescence is undoubtedly better.

DM is a mostly hereditary disease, not an infectious disease. Even so, it does not mean that the condition must decrease to the child, also though both parents suffer from DM disease. When compared with both normal parents (non-DM), it is clear that DM patients are more likely to have

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children who suffer from DM disease (Nainggolan, Kristanto & Edison, 2013).

Based on the results of research by (Wicaksono,2011). of 30 in Rowosari Health Center patients, 24 had a history of DM in their families (with a percentage of 80%), and six had no history of DM in their families (with a rate of 20%). N the opinion of researchers even though the family history of suffering from DM is a risk factor for type 2 DM Mellitus that cannot be modified, it does not mean that prevention efforts cannot be carried out. It is precisely by knowing family history; it can make a person more careful to regulate a healthy lifestyle to avoid DM Mellitus type 2 disease. By protecting themselves from the disease, not only save yourself, but also protect our offspring from the risk of developing this illness. It is recommended to the public, especially for those who have a family history of DM always make early detection of Type II DM, so that direct prevention efforts can be carried out as early as possible.

Smoking can increase the risk of developing DM in several ways. Blood that has been poisoned by techno tines will cause impaired insulin sensitivity. If the conditions are like that, then DM is ready to lurk. Smoking can increase the risk of developing diabetes in several ways. Smoking has been shown to cause an increase in blood glucose concentrations and can increase insulin resistance (Susilo, 2011).

The distribution of as cases and controls in this study were 50% each of the total totaling 74 patient. The distribution of according to smoking status is far more than those who do not smoke than those who smoke. who never smoking reached 68.9%, while those who smoked were only 31.1% of the total , amounting to 74 patient. In women, smoking may have an "anti-estrogenic" effect, causing adverse changes in the waist-hip ratio. The increased waist-hip ratio is significant positively correlated with insulin resistance, plasma glucose levels and *DM overt*. Therefore, the effect of smoking on the development of DM may be mediated through changes in fat distribution (Hidayati & Kushadiwijaya, 2013). Smoking is one risk factor for the occurrence of Type 2 diabetes. Cigarette smoke can increase blood sugar levels. The effect of tobacco (nicotine) stimulates the adrenal glands and can raise glucose levels. Smoking can reduce HDL cholesterol levels or "good cholesterol" in the bloodstream; smoking can also make blood easily freeze, which increases the likelihood of arterial blockage.

Healthy lifestyle following with physical activity is necessary. The amount of energy for action depends on the intensity or light weight of a job. As heavy as a job, the more power needed. Energy for activity can be calculated by multiplying the correction factor according to the activity level with BMR energy (Maryam, 2008). That the majority of with physical activity was quite adequate, reaching 70.3%, while those categorized as less were only 29.7% of the total . According to researchers, physical activity is very beneficial to improve blood circulation, reduce weight and improve sensitivity to insulin, which will improve blood glucose levels (Utami, 2011; Maindi, 2015).

Waist circumference is one of the parameters of a person's body fat, and settings that can describe a person's weight, primarily related to IAAT (*Intra Abdomen Adipose Tissue*), accurate examination of IAAT can be done with CT scans and MRI, but it is difficult to do for large populations because of the high costs and side effects of exposure to radiation. Metabolic Syndrome is a collection of body function deviations in the form of central obesity (obesity mainly based on the excessive abdominal circumference), high blood pressure (pre-hypertension or hypertension), dyslipidemia (increased LDL cholesterol levels, triglycerides, and low HDL levels), resistance disorders insulin or Type II DM (Susilo, 2011).

Another study found that from of 75 of 29 samples with obesity and high postprandial blood sugar levels. Men with abdominal obesity risk 4.85 times affected by type 2 diabetes compared to men with waist circumference <90 cm, whereas in women with abdominal obesity at risk 6.5 times affected by type 2 diabetes compared to women with waist circumference <80 cm. BMI ≥30 in men has a chance of 6.41 times greater than BMI 25-29.9 for the occurrence of type 2 DM and 3.75 times in women (Sari, 2010; Susilo, 2011).

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The opinion of researchers, the use of waist circumference as a variable is an advantage of this study. Waist circumference measurement is a simple, effective, inexpensive, and inexpensive anthropometric measurement that is used as an indicator of metabolic syndrome compared to other indicators such as body mass index. The waist circumference measurement procedure is easy to understand by the sample so the sample can be more cooperative. Excessive food intake and decreased energy expenditure create a positive energy balance. Positive energy balance that occurs from excessive food intake mainly comes from excess energy intake and carbohydrate sources, resulting in excessive fat accumulation in abdominal adipose tissue.

DM is a mostly hereditary disease, not an infectious disease. Even so, it does not mean that the condition must decrease to the child, also though both parents suffer from DM disease. When compared with both of their normal parents (non-DM), it is clear that DM patients are more likely to have children suffering from DM disease (Susilo, 2011). Patient who did not have a history of DM and suffered from type 2 diabetes mellitus were two patient (9.5%) and who did not have a history of DM and did not suffer from type 2 diabetes mellitus were four patient (44.4%) (Rosdiati, 2013). Based on the results of the study, it was known from 42 who had a family history of DM, 21 (28.4%) had DM. This was same in with the theory which revealed that one of the factors associated with the occurrence of DM was family history. One member of the family, then someone has the risk of being in the category of being affected by type 2 diabetes, and if many family members have a history of DM, then the person has the most significant risk of developing type 2 diabetes. The statistical test results show that there is a relationship significant between family history of DM with Type 2 diabetes. But from the results of the study, it was also known that as many as 21 (28.4%) did not DM because family history was not the dominant factor associated with DM. Regular exercise activities to avoid DM disease. Of the 32 who did not have a family history of DM with 6 (18.8%) of had DM because there were many causes of DM, perhaps if the family did not suffer from DM, did not maintain their diet, poor lifestyle, obesity so the respondent suffered from DM disease even though there was no history of DM in the family.

Smoking can increase the risk of developing diabetes in several ways. Cigarettes are the biggest enemy of health. Nicotine that spreads in the blood will affect the workings of all organs of the body. Blood that has been poisoned by techno tines will cause impaired insulin sensitivity. It was shown that there were more patient with type 2 DM and typed 2 DM who had no smoking status. The results of the statistical test obtained the value of p = 1, meaning that at 10% alpha there was no significant relationship between smoking habits and Type 2 DM (Susilo, 2011; Erniati, 2013).

Based on the results of the study it was found out of 30 who smoked, as many as 16 (53.3%) had DM in line with the theory where one of the factors associated with DM disease is the smoking habit because in cigarettes This nicotine substance initially enters through the respiratory tract and reaches the blood vessels. In nicotine, blood can spread throughout the body, especially in the brain. The content of nicotine in the blood turns into cotinine. This nicotine substance can stimulate the release of the hormone cortisol which results in increased glucose breakdown. If smoking behavior continues then the glucose breakdown process is also so that it can disrupt the glucose storage process 2 hours after consuming food which then causes the occurrence of impaired glucose tolerance (TGT) and as many as 14 (46.7%) not DM this is possible According to researchers smoking does increase the risk of DM in men where they become vulnerable to premature death, but smoking is associated with a reduced risk of DM in men who can survive to a much older age. This is because patient who smoke who have survived to old age must have a unique ability to fight against the harmful effects of smoking on health.

The modern lifestyle now, many activities can be done quickly and practically, every one look for everything that is easy and practical so that the body automatically does not move. Also, with the unusual activity, patient feel they have no time to exercise. The result is a lack of movement and lack of exercise

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(Susilo, 2011). This condition triggers high cholesterol and also the presence of blood pressure that continues to strengthen to give rise to hypertension. An inactive lifestyle (lazy to exercise) can lead to DM mellitus in patient with reduced sensitivity (Susilo, 2011). . Based on the results of the study it was found out that 36 who had less / low physical activity, as many as 21 (58.3%) experienced DM and as many as 15 (41.7%) did not DM. Of the 38 who have sufficient/moderate physical activity, as many as 6 (15.8%) experience DM and as many as 32 (84.2%).

According to researchers for senior women, most of them still carry out household work such as washing and sweeping the yard and walking to the recitation place so that the percentage of senior women who carry out sufficient and less physical activity is not much different. However, for the elderly male most of them have not done any physical activities, even walking which is a type of mild physical activity rarely applies it. Therefore, it is necessary to promote and preventive efforts to increase the motivation and awareness of the community, especially the elderly, to carry out regular physical activities at least a total of 30 minutes per day for five days a week should be encouraged. Physical activity carried out can be in the form of housework, farming, or walking which must be carried out at least 10 minutes in one action and the total time of execution of one type of exercise per day is at least 30 minutes. These efforts can be carried out by distributing flyers or posters, counseling, or providing an elderly afternoon or gymnastics walking activities guided by an older adult. Fat tissue has two functions, namely as a place for storing fat in the form of triglycerides, and as endocrine organs. Fat cells produce various hormones called adipocytokine (adipokine), namely leptin, tumor necrosis factor-alpha (TNF-alpha), interleukin-6 (IL-6), resistin, and adiponectin. These hormones also play a role in insulin resistance. Figure 2 shows the relationship of fat tissue to the occurrence of insulin resistance (Susilo, 2011). The results of the study were typed 2 DM and not more type 2 DM who had size waist circumference is risky (Erniati, 2013). The statistical test results obtained p-value = 0.753, meaning that at 10% alpha there was no significant relationship between waist circumference and DM Type 2. And finding a positive correlation between waist circumference with triglyceride levels, plasma glucose levels, and blood pressure, but not for HDL cholesterol levels (Jalal, 2015).

Based on the results of the study, it was found out that 26 who had risky waist circumference, as many as 15 (57.7%) experienced DM and as many as 11 (42.3%) did not DM. Of the 48 who had a waist circumference not at risk, as many as 12 (25.0%) experienced DM and as many as 36 (75.0%) did not DM. According to researchers, most of the elderly with type 2 DM sufferers have suffered from DM for more than five years. Of course, in that period it did not rule out the possibility that the shrinking weight and size of the ' circles could increase again because during this period they could change their lifestyle and diet based on doctor's advice.

CONCLUSION

The who suffered from DM is 27 (36.5%) and those without DM is 47 (63.5) that there has a family history of DM, which was 42 (56.8%), who are smoker as many as 30 (40.5%) and that lack physical activity, 36 (48.6%), who have risky waist circumference as many as 26 (35.1%). It is known that the statistical test results obtained p-value = 0.007 which means <α, it can be concluded that there is a relationship between family history of DM and the occurrence of DM. With an OR value of 4,333, it means that the respondent has a family history of DM with a risk of 4 times greater DM if compared with who do not have a family history of DM. There is a relationship (p-value = 0.016 which means <α), of smoking with the occurrence of DM. With a value of OR 3.429, it says that who are smoker have a risk three times greater than DM when compared to who do not smoke, there is a relationship between physical activity p-value = 0,000 which means <α and the occurrence of DM. With an OR value of 7,467, it says that who have less physical activity have a risk 7 times more likely to develop DM when compared to who have sufficient/moderate physical activity, and that there is

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a relationship between waist circumference p-value = 0.011 which means <α, and the occurrence of DM. With a value of OR 4,091, it says that with waist circumference are at risk of having four times greater risk of developing DM when compared to who have a waist circumference, not at risk.

SUGGESTIONS

Provide information about magnesium-rich foods such as grains, legumes, and green vegetables through counseling, distributing leaflets or other media. Extension or distribution of booklets that provide information about foods containing low glycemic loads such as vegetables (broccoli, kale, beans, tomatoes, carrots, pumpkins), fruits (berries, pears, melons, watermelons, cherries), nuts - nuts (green beans, peanuts, soybeans, peas), and wheat. Blood glucose measurement should use the most accurate method, which is glucose testing by an enzymatic method with venous plasma blood material and in a trusted laboratory.

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