Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Nursing Science (International Program)

Prince of Songkla University

2016

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Thesis Title Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus

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Abstract

This descriptive correlation study was aimed to describe the level of perceived benefits, the level of perceived barriers and the level of treatment adherence, and to examine the relationship between perceived benefits, perceived barriers and the treatment adherence among Indonesian older adults with type 2 diabetes mellitus. Purposive sampling technique was used to recruit 164 type 2 diabetes mellitus (T2DM) among older adults from PERSADIA Bandar Lampung, Indonesia who met the inclusion criteria. Each participant was asked to fill in the demographic and health information form (DHIF) questionnaire, perceived benefits, perceived barriers, and treatment adherence questionnaire. The instruments were validated by 3 experts. Reliability was done for the Indonesian version of the perceived benefits, perceived barriers, and treatment adherence questionnaire and was tested with 30 participants with diabetes mellitus. Cronbach's alpha revealed a reliability score of perceived benefits is 0.92, perceived barriers 0.81, and treatment adherence 0.82. Descriptive statistics were used to analyze demographic data, level of perceived benefits, perceived barriers, and treatment adherence. Pearson's correlation was used to analyze the relationship between perceived benefits, perceived barriers, and treatment adherence.

The findings showed that the level of perceived benefits was at a high level (*Mean* = 3.23, *SD* = .66), perceived barriers was at a low level (*Mean* = 1.81, *SD* = .73), and treatment adherence was at a moderate level (*Mean* = 2.83, SD= .80). There is a positive significantly correlation between perceived benefits and treatment adherence (r = .690, p >0.001) and there is a significantly negative relationship between perceived barriers and treatment adherence (r =-.453, p >0.001).

The result from the study can be applied as an information to understand the perception toward treatment adherence among older adults with type 2 diabetes in Indonesia and developed an intervention to increase the level of perceived benefits and to decrease the level of perceived barriers toward treatment adherence.

ACKNOWLEDGEMENT

Praise God and give thanks to Him for His blessing and love to me so I am able to finish my study in Prince of Songkla University, Hatyai, Thailand and finish my thesis in the right time. In writing this thesis, all of my family, Ajarns, and friends have always supported me and had prayed for me so that I am able to finish my study in time. For this, I would like to say thank you from the bottom of my heart to my major advisor Assist.Prof. Dr. Ploenpit and co- advisor Assist.Prof. Dr. Kantaporn for their patience, support, suggestions, and kindness to guide my thesis project so I can finish my study here in Prince of Songkla University. I would like to thank the examining committee for their great suggestions. My great appreciation also goes to the director of PERSADIA Bandar Lampung, Indonesia for allowing me to perform my data collection and also for all of the participants who were willing to help me to finish the data collection. I would also like to thank the chairperson of the International Masters Nursing Program, Assist. Prof. Dr. Waraporn for her kindness and support and a special thanks goes to the Dean of the Faculty of Nursing, Prince of Songkla University, Thailand. Thanks also to the Graduate School, Prince of Songkla University for providing scholarship, Thailand's Educations Hub for southern Region of ASEAN countries (TEH-AC) to pursue Masters Degree and thesis funding to complete this study.

I would like to thank my beloved family who has given so much contributionto my study, their love, sacrifice, patience, and support has made me a better person.

DWIGHT HUTAPEA

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Chapter 1

Introduction

Chapter one presents the background and significance of the problem, objectives of the study, research questions, conceptual framework, definition of terms, the significance of the study, and benefit of the study.

Background and Significance of the Problem

Diabetes mellitus is a chronic endocrine disorder characterized by high levels of blood glucose and this condition is called hyperglycemia. This endocrine disorder is a common and serious problem and it occurs all around the world. The prevalence of diabetes was estimated to be 6.4% in 2010 and this will increase to 7.7% in 2030 (Shaw, Sicree & Zimmet, 2010). The World Health Organization (WHO) has predicted that the worldwide prevalence of diabetes mellitus will increase to 300 million cases in the year 2025 (Pradeepa, Deepa & Mohan, 2002). According to the International Diabetes Federation (IDF), the national prevalence of diabetes in older adults aged ≥ 60 years old in Indonesia was 9 million cases in 2014. The death of 175,936 older adults in Indonesia is due to diabetes, and the number of cases of diabetes in older adults that are undiagnosed is 4,854. Even today the prevalence of diabetes mellitus among older adults in Indonesia is ranked fourth in the world after India, China, and the United States of America (Shaw, Sicree & Zimmet, 2010).

Type 2 diabetes mellitus is known as non-insulin dependent diabetes. Many of the cases of type 2 diabetes mellitus are due to a metabolic disorder where the body is unable to make enough insulin or to use insulin properly (Kahn, 2003).

Furthermore, the problem of type 2 diabetes mellitus in older adults causes insulin resistance. This is due to initial preconditions of the decrement in insulin sensitivity and the alteration or insufficient compensation of functional beta cell mass thus increasing insulin resistance that can cause hyperglycemia which accelerates the onset of late diabetes complications (Suastika, Semadi, Dwipayana, & Kuswardhani, 2012). Diabetes complications include cardiovascular diseases, atherosclerosis, retinopathy, neuropathy, chronic kidney disease, and diabetic ulcers. These diabetes mellitus complications can be prevented by treatment adherence (Asante, 2013).

The term of adherence was introduced as an active role of patients and to describe the needs of the patient's agreement with a persistence in practice and maintain patients health behaviors (Alikari & Zyaga, 2014). Treatment adherence is an activity in actively participating with the willingness and persistence in relation to the health care recommendations (Asante, 2013). Treatment adherence is important for type 2 diabetes patients to maintain normal levels of blood glucose to prevent complications. Otherwise, without treatment adherence, poor glycemic control will occur, and this will lead to higher levels of glycosylated hemoglobin (HbA1c). Thus increasing the incidence of serious complications which will subsequently increase the level of morbidity and mortality.

A study in Korea among older adults visiting a certain hospital found that only 37 % of the patients had glycosylated hemoglobin less than 7 %. This indicated that blood glucose levels were not being controlled properly (Park et al., 2010). A study in Ghana by Asante (2013) reported that treatment adherence in type 2 diabetes mellitus population was often suboptimal, ranging from 35% to 86 %. Therefore, there is a need to increase and maximize the level of treatment adherence among type 2 diabetes mellitus patients. These two studies from Asante (2013) and Park et al

(2010) indicated that treatment adherence was a major challenge around the world for a long-term diabetes care.

Treatment adherence among older adults age ≥ 60 years old American Diabetes Association (2015) needs more attention because of the comorbidities and disabilities. Most older adults with diabetes have at least one comorbid condition, and as much as 40% have three or more distinct comorbid conditions. Comorbidities can have a negative impact on treatment adherence (Beverly, Wray, Chiu, & LaCoe, 2014). In older adults with diabetes, the risk of disabilities is related to mobility. In the United States, approximately 25% of older adults with diabetes are unable to climb stairs, or do housework, and about 50% have difficulty in performing these tasks. These disabilities can have a negative impact on treatment adherence because the patients cannot follow all of the treatment adequately and this can have a negative impact on treatment adherence (Kim et al., 2012).

Martin, Williams, Haskard and DiMatteo, (2005) and Petek, Rotar-Pavlic, Kersnik, and Svab (2010) reported that among the reasons why treatment adherence is low among older adults is because the treatment recommendations are very complex to follow and require lifestyle changes and modification in relation to existing habits. This modification requires many changes in making decisions about adjustments for treatment adherence on a daily basis in order to achieve a balance in living with diabetes. There are four dimensions of treatment adherence and these are (1) medication adherence, (2) dietary behavior, (3) physical activity, and (4) regular self-monitoring of blood glucose. These dimensions are associated with an improvement in blood glucose levels and individual behavior (Asante, 2013).

Treatment adherence is a promoting behavior because treatment adherence is important to improve health behavior and well-being and also provide strategies in

promoting treatment adherence (Haskard, Kelly, & Robin, 2010). A health promotion model is important in promoting health behavior. Pender's Health Promotion Model (PHPM) aims to increase health behavior and well-being to achieve good health (Pender, Murdaugh & Parsons, 2014). According to PHPM, there are several factors that affect well-being. One of these factors is behavior-specific cognitions. The variables of this factor are perceived benefits, perceived barriers, perceived self-efficacy, activity-related affect, interpersonal influence, and situational influences (Pender, Murdaugh & Parsons, 2014).

In this study, the researcher focused on the perceived benefits and perceived barriers to understanding the perceptions of the older adults toward treatment adherence. The perceptions of older adults as patients are important to health care providers to help these patients to improve their health. If a patient's perception is positive, it will bring benefit to the patient's health, on the other hand, if the patient has a negative perception, this will cause barriers in following the treatment (Glanz, Rimer & Viswanath, 2008). A study from Mohebi, Azadbakht, Sharifirad, & Kargar, (2013) mentioned that reviewing health promotion model was found 61% to influence health behavior.

In the health promotion model, perceived benefits act as motivational factors of behavior and indirect motivational factors of behavior through a commitment to performing the behavior anticipate benefits of which will be achieved (Pender, Murdaugh, & Parsons, 2014). Perceived benefits related to perceptions of the usefulness of taking action to reduce disease risk or the perception of healthy action benefits (Glanz, Rimer, & Viswanath, 2008). According to Pender, Murdaugh and Parsons (2014), perceived benefit is defined as a perception of a positive outcome resulting from the health behavior. This perceived benefit is proposed to directly or

indirectly motivate the individual to make a plan of action to carry out the behaviors. Older adults should have the knowledge and understanding of the importance and benefits of good health behavior as well as the consequence of not adhering to treatments in diabetes care (kirkman et al., 2012).

The perceived barrier is defined as a perception of obstacles that will get in the way of achieving the target health behavior (Pender, Murdaugh & Parsons, 2014). Perceived barriers and obstacles are proposed to directly or indirectly demotivate the planning of an action to carry out the behavior. These opposing perceptions have a negative effect on each other. Perceived barriers are also defined as a perception concerning the unavailability, inconvenience, expense, difficulty, or time-consuming nature of a particular action resulting from a health behavior (Pender, Murdaugh & Parsons, 2014).

A study from Glanz, Rimer, and Viswanath, (2008) has shown that barriers frequently affect the intention of doing a special behavior and actual performance of the behavior. Another study has tested health promotion model, 79% have expressed the importance of barriers as a determinant of health promoting behavior. Regarding health promotion behaviors, barriers may include non-availability, lack of suitability, expensiveness, difficulty of a special act. Barriers are often considered as personal expenses resulting from a behavior and usually stimulate an incentive for preventing a behavior's acquisition (Mohebi, Azadbakht, Sharifirad, & Kargar, 2013).

A study in the USA explored the perceived barriers to physical activity among older adult patients in the African American population of women. The result of the study showed that the subject experienced barriers such as limited time, fatigue, demanding family responsibilities, and low motivation (Williams et al., 2006). Physical activity is an important part of treatment adherence essential to the diabetes

care in older adults. Therefore physical activity among older adults has barriers which will affect treatment adherence because physically is difficult among many older adults due to their muscle mass, general mobility, strength, and energy. Therefore, physical activity among older adults needs to be planned (Meulemen et al, 2000). Another study by Brooks (2002) examined the barriers to treatment adherence among women with pregnancies complicated by diabetes mellitus among African American women. This study found that these women reported the greatest number of barriers to treatment adherence in the diet and barriers to blood glucose level. Moderate adherence was reported by the women in this study, indicating that even though the treatment regimens were difficult, they did experience barriers to their treatment.

These two studies only focused on the perceived barriers to physical activity among older adults, and barriers to treatment adherence was a behavior among women with pregnancies. Perceived benefits are proposed to, directly and indirectly, motivate behavior through determining the extent of a commitment to plan an action to engage the behaviors. In another hand perceived barriers consist of negative perceptions of a particular to the action than the expected behavior is likely to take place (Pender, Carolyn, & Mary, 2014). Therefore, it is important to explore the relationship between perceived benefits, perceived barriers, and treatment adherence among older adults.

There have been no studies in Indonesia that have examined the relationship between perceived benefits, perceived barriers to treatment adherence of type 2 diabetes mellitus among older adults. Due to the aforementioned reasons, the researcher conducted this study about the perceived benefits, perceived barriers, and treatment adherence among older Indonesian adults with type 2 diabetes mellitus. The researcher is interested in studying the relationship between perceived benefits,

perceived barriers, and treatment adherence among Indonesian older adults with type 2 diabetes mellitus.

Objectives of the Study

The objectives of this study were as follows:

1. To identify the level of perceived benefits, the level of perceived barriers and the level of treatment adherence among older adults with type 2 diabetes mellitus.

2. To examine the relationship between perceived benefits, perceived barriers and treatment adherence among older adults with type 2 diabetes mellitus.

Research Questions

This study aimed to answer the following research questions:

1. What is the level of perceived benefits, the level of perceived barriers and the level of treatment adherence among older adults with type 2 diabetes mellitus?

2. Are there any relationship between perceived benefits, perceived barriers and treatment adherence among older patients with type 2 diabetes mellitus?

Conceptual Framework

The conceptual framework of this study is based on the Pender Health Promotion Model (PHPM) which was developed by Pender, Murdaugh, and Parsons (2014). The PHPM framework is used for integrating nursing and behavioral science perspectives with factors influencing health behaviors. The concept of PHPM is the unique personal characteristics and experiences that affect subsequent actions. Health promoting behavior is the desired outcome in improving health. The PHPM is based on the assumption that each person needs to actively regulate his/her own behavior.

Developing the health promoting behavior of individuals could be affected by several factors. The factors that influence human health consist of: (1) individual characteristics and experiences shown by related behavior, and personal factors, (2) specific cognitions such as perceived benefits of action, perceived barriers to action, perceived self-efficacy, activity-related affect, interpersonal influence, and situational influences, and (3) behavioral outcomes such as commitment to a plan of action, preferences, and health-promoting behavior (Pender, Murdaugh and Parsons (2014).

Treatment adherence among older adults aged ≥ 60 years old is more challenging because need more attention because of the comorbidities and disabilities that may affect health outcomes (Beverly, Wray, Chiu, & LaCoe). Treatment adherence recommendations are very complex for older adults to follow because require lifestyle changes to existing habits (Petek, Rotar-Pavlic, Kersnik & Svab, 2010). Older adults should understand the importance and benefits of good health behaviors as well as the consequences of not adhering to the treatment of diabetes mellitus (Kirkman et al., 2012).

In this study treatment adherence was used as a behavior outcome designed for the older adults with type 2 diabetes mellitus. Based on Asante (2013), treatment adherence is categorized into four dimensions: (1) medication adherence, (2) dietary behavior, (3) physical activity, and (4) regular self-monitoring of blood glucose. The importance of these treatment adherence dimensions toward patients with diabetes mellitus is to maintain normal blood glucose and to prevent the occurrence of complications (Asante, 2013).

Through the study framework, it is proposed that perceived benefits and perceived barriers are related to the treatment adherence among older adults with type 2 diabetes mellitus. Perceived benefits to an action is a perception of the positive

consequences of adopting a health behavior (Pender, 2011). It is the perceived benefits that positively reinforce the behavior and consequently treatment adherence (Pender, Murdaugh & Parsons 2014). Whereas, perceived barriers to an action is a negative perception that blocks and demotivates the undertaking of the health behavior. Anticipated barriers have been repeatedly found to lower motivation to engage in a particular health behavior (Pender, 2011). Treatment adherence is the behavior outcome that consists of medications, dietary behavior, physical activity, and the regular self-monitoring of blood glucose (Asante, 2013).

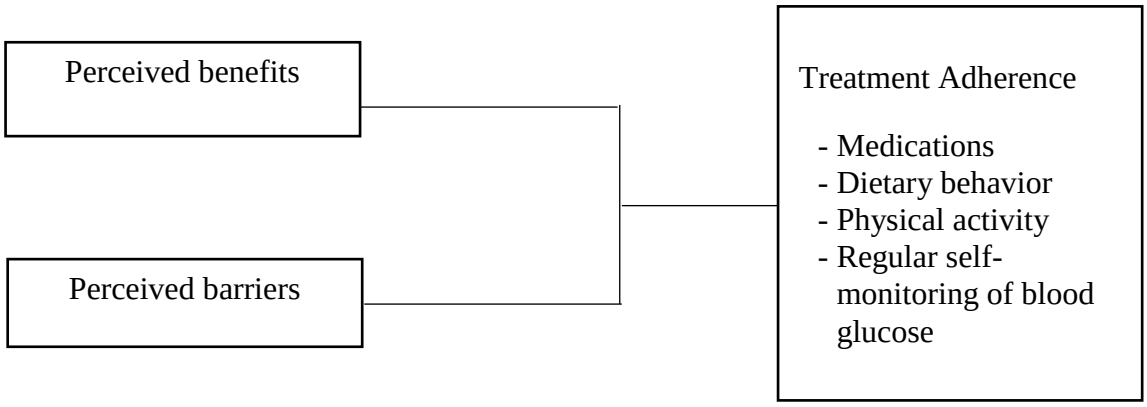

Figure 1. Conceptual Framework of the Study

Hypothesis

There is a positive relationship between perceived benefits and treatment adherence and there is a negative relationship between perceived barriers and treatment adherence among Indonesian older adults with type 2 diabetes mellitus.

Definition of Terms

Treatment adherence. Treatment adherence refers to older adults with type 2 diabetes mellitus activities in actively participating with willingness and persistence in relation to the health care recommendations. The components of treatment adherence consisted of medication adherence, dietary behavior, physical activity, and the regular

self-monitoring of blood glucose levels. The components of treatment adherence were measured using the Diabetes Compliance Questionnaire (DCA) developed by Brooks (2002) and modified by the researcher. Higher level indicated higher levels of adhering to treatment adherence.

Perceived benefits. Perceived benefits refer to older adults with type 2 diabetes mellitus perceptions of a positive outcome resulting from the health behavior according to the practice of the four dimensions of treatment adherence; medication adherence, dietary behavior, physical activity, and regular self-monitoring. The perceived benefits of type 2 diabetes mellitus treatment adherence were measured by the questionnaire developed by Sechrist, Walker and Pender (1987) which was modified by the researcher considering the relevance of it to the study. The higher level indicated higher positive perceptions.

Perceived barriers. Perceived barriers refer to the older adults with type 2 diabetes mellitus negative perceptions that block and demotivate the undertaking of a health behavior according to the practice of the four dimensions of treatment adherence; medication adherence, dietary behavior, physical activity, and regular self-monitoring when complying with treatment adherence in diabetes control. The perceived barriers to type 2 diabetes mellitus treatment adherence were measured by the questionnaire developed Sechrist, Walker and Pender (1987) and modified by the researcher considering the relevance of the study. The higher level indicated higher negative perceptions.

Scope of the Study

This study measured the level of perceived benefit, perceived barriers and treatment adherence and the relationship between perceived benefits, perceived

barriers, and treatment adherence among older Indonesian adults with type 2 diabetes mellitus as members of the Indonesian Diabetes Association otherwise known as PERSADIA in Bandar Lampung city, West Sumatera, Indonesia. Data was collected from February 2016 to April 2016.

Significance of the Study

The result from this study can be used as an information regarding to the level of perceived benefits, perceived barriers and treatment adherence and relationship between perceived benefits, perceived barriers, and treatment adherence could be used in formulating a health education strategy to help older adults with type 2 diabetes mellitus adhere more to the treatment they receive. The findings can be a useful information and evidence to enhance treatment adherence behaviors among older adults with type 2 diabetes mellitus. Furthermore the study help to explore the perceptions of older adults toward treatment adherence, which benefits the nurses in dealing with older adults with type 2 diabetes mellitus and minimizing the barriers toward treatment adherence.

Chapter 2

Literature Review

Chapter two discusses the relevant literature review. The review covers the following topics:

1. Overview of type 2 diabetes mellitus
    1.1. Definition and pathogenesis of type 2 diabetes mellitus
    1.2. Signs and symptoms of type 2 diabetes mellitus in older adults
    1.3. Complications of type 2 diabetes mellitus in older adults
2. Health care system for older adults with diabetes mellitus in Indonesia
3. Pender's Health Promotion Model (PHPM)
4. Treatment adherence among older adults with type 2 diabetes mellitus
    4.1. Definition of treatment adherence
    4.2. Goal of treatment adherence
    4.3. Components of treatment adherence
    4.4. Measurement of treatment adherence
5. Factors related to treatment adherence among older adults with type 2 diabetes mellitus
6. Perceived benefits, perceived barriers and treatment adherence among older adults with type 2 diabetes mellitus
    6.1. Perceived benefits and treatment adherence
    6.2. Measurement of perceived benefit
    6.3. Perceived barriers and treatment adherence
    6.4. Measurement of perceived barriers

Overview of Type 2 Diabetes Mellitus

The definition and pathogenesis, sign and symptoms, and complications of diabetes mellitus are described in the following section.

Definition and pathogenesis of type 2 diabetes mellitus

Type 2 diabetes is a chronic disease characterized by high levels of blood glucose and it is referred to non-insulin dependent diabetes where the individuals have insulin resistance and insulin deficiency. During digestion, food is broken down into basic components. Carbohydrates are broken down into simple sugars, primarily glucose. Glucose is a critically important source of energy for the body's cells. To provide energy to the cells, glucose needs to leave the blood and be uptaken by the cells. Insulin is a hormone produced by the pancreas that helps the entrance of the glucose into the cells (Kahn, 2003).

Type 2 diabetes occurs when the insulin receptors of the cell are insensitive to the insulin present in the blood. This condition is insulin resistance. Since the glucose does not enter the cells, glucose starts to build up in the blood and its concentration may remain high. The pancreas responds to this condition by producing and secreting more insulin for the purpose of facilitating the entrance of more glucose into the cells to achieve a normal blood glucose level. Over time, the insulin resistance gets progressively worse. In response, the pancreas increases its insulin production even more. As a consequence, the pancreas is gradually depleted of its ability to produce more insulin and this occurs when the volume of the islet cells of the pancreas decreases and subsequently the beta cells fail to produce insulin sufficiently, thus producing a condition called insulin deficiency (American Diabetes Association, 2015). It can no longer produce the amount of insulin that can match the

demand for more and more insulin. As a result, the blood glucose level stays high and this will cause the metabolic disorder diabetes mellitus type 2 (Hoehn et al., 2009).

Individuals can be diagnosed with diabetes based on the following criteria (American Diabetes Association, 2015): Fasting plasma glucose (FPG) and random blood glucose (RBS):

1. Fasting plasma glucose level with normal level <100 mg/dL, high risk of diabetes mellitus FPG ≥100-125 mg/dL, and diabetes mellitus level FPG ≥126 mg/dL.
2. Random plasma glucose level with normal level 2-h PG <140 mg/dL, high risk of diabetes mellitus 2-h PG <140 mg/dL, and diabetes mellitus level 2-h PG ≥200 mg/dL.
3. The target of the achieving glycemic control measures for good diabetes control includes 7% for hemoglobin A1c (HbA1c) or less than 154 mg/dl.

Signs and symptoms of type 2 diabetes mellitus in older adults

The sign and symptoms of diabetes mellitus include poorly controlled HbA1c (≥ 7 %) or fasting blood glucose (FBG ≥ 200 mg/dL) and hyperglycemia. The symptoms of hyperglycemia are manifested when the blood glucose is persistently above 15 mmol/L (270 mg/dL), lethargy, polyuria, frequent fungal or bacterial infections, blurred vision, loss sensation, and poor wound healing (American Diabetes Association, 2015).

Older adults may not recognize the changes in clinical symptoms of diabetes mellitus due to their affected cognitive ability and the belief that the symptoms are a part of growing old and the normal physiological changes associated with aging. In regards to these reasons, older adults with diabetes rarely become aware of the symptoms of hyperglycemia (Meneilly & Tessier, 2001). Their lack of awareness of

the changes can make the recognition and treatment of diabetes problematic because about half of type 2 diabetes mellitus older adult population do not know that they have developed diabetes mellitus (Meneilly & Tessier, 1999).

The renal threshold for glucose increases with advanced age and glycosuria is not at usual levels (Meneilly & Tessier, 2001). Another example, polydipsia or increased thirst is often associated with advanced age, thus the presence of this symptom may not be recognized as a symptom of diabetes. Dehydration is more common in older adults because of hyperglycemia and an altered thirst perception that delays fluid intake. More often, changes such as confusion, incontinence, and complications are related to symptoms of diabetes (Meneilly & Tessier, 2001).

Complications of Type 2 Diabetes Mellitus in older adults

Older adults with type 2 diabetes mellitus are at high risk of developing both short-term and long-term complications. The short-term complications are hypoglycemia and hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome, which leads to stupor, coma, and death if not treated adequately (American Diabetes Association, 2008). Short-term complications also include infections such as cutaneous furunculosis and carbuncles, vulvovaginitis, cellulitis, urinary tract infection, and ear infections, which can lead to metabolic abnormalities and type 2 diabetes mellitus coma (Stratton et al, 2000).

The long-term complications include vascular disease (both microvascular and macrovascular), neuropathic conditions (sensorimotor neuropathy and autonomic neuropathy), and a mix between vascular and neuropathic diseases (Stratton et al, 2000). Microvascular diseases include accelerated retinopathy and nephropathy; whereas cardiovascular diseases include accelerated coronary atherosclerosis,

accelerated vascular atherosclerosis, and accelerated peripheral vascular diseases (Suastika, Semadi, Dwipayana, & Kuswardhani, 2012).

In terms of diabetes complications, in Indonesian patients the most prevalent type 2 diabetes mellitus complications are: neuropathy (78-13%), albuminuria (77.7-33%), microvasculer complications (53-27.6%), decreased glomeral filtration rate (43.7-75%), retinopathy (42.6-17.2%), nephropathy (26-7.3%), macrovasculer complications (20-16%), and type 2 diabetes mellitus foot complications (24-73%) (Soewondo, Ferrario, & Tahapary, 2013).

Health Care System for Older Adults with Diabetes Mellitus in Indonesia

The aging process impacts on a society, economy, and health. Health is important for older adults due to several impairments, either physical or psychological (Cornwell & Laumann, 2015). Therefore, the Indonesian government has formulated a variety of health care policies for the older adults to improve their health and to achieve happiness with their families and others (Ministry of Health of Indonesia, 2013). Indonesian law concerning older adults' welfare (Undang-undang nomor 13 tahun 1998) contains the main points of health, such as coaching in regards to the welfare of older adults which includes promotive, preventive, curative, and rehabilitative measures.

Each public health center in Indonesia offers services for older adults. The part of the center that services older adults are called the Older Adults Care Unit. It is a health care service for adults aged 60 years or older. The Older Adults Care Unit was established to meet the requirements of the Indonesian government policy. Every Older Adults Care Unit has three nurses and one doctor to provide health services and education related to the health information of older adults such as giving poster

according to the patient's disease, group gathering according to their disease, and include family in this education program so the family can give support to the patients. Every older adult is given kartu menuju sehat (KMS) which is a card that functions to record the physical or mental health condition, and health process of the older adult. On their first visit, the older adults undergo a health check for vital signs, a physical examination, and clinical tests are performed (Soewondo, 2014).

PERSADIA Bandar Lampung, West Sumatera, Indonesia is part of a health center that services older adults with diabetes mellitus. Every older adult have a nurse and doctor to provide health services and education related to diabetes mellitus such as giving poster or leaflet about diabetes, training older adults to consume medication on time, eat healthy food, exercise regularly, and check blood sugar. Every 2 times a week Tuesday and Thursday Nurses in PERSADIA will do exercise together with the patients besides exercise nurses will also check health for vital signs such as blood pressure, and blood glucose. Every month PERSADIA will also have a gathering with the patients. The health care providers always make a good relationship with the patients and they try to make the patients understand how to treat diabetes.

The situation of diabetes mellitus in Indonesia is one of the non-communicable diseases that is on the rise in its prevalence and incidence. DM is a serious threat to health development because it can cause blindness, kidney failure, type 2 diabetes mellitus foot complications, heart disease and stroke (Karter, 2015). It is obviously frightening for the Indonesian people in general. As a chronic disease, it is not only in Indonesia that its prevalence is increasing, this is also occurring around the world (Karter, et al., 2015).

The data from the Indonesian National Health Research showed that in Indonesia there is more than 70% of undiagnosed diabetes cases. However, this

estimate hides a large variation within the country with the lowest prevalence in the province of East Nusa Tenggara (1.8 %) and the highest in the provinces of West Kalimantan and North Maluku (Soewondo, Ferrario, & Tahapary, 2013). An epidemiological study in the urban areas of Indonesia has shown an increase of diabetes prevalence in the last 30 years.

Pender's Health Promotion Model (HPM)

Pender's Health Promotion Model (PHPM) is an attempt to depict the multidimensional nature of a person interacting with his/her interpersonal and physical environments as any action or behavior is carried out as they pursue health and well-being. An individual health-promoting behavior can be affected by many factors, such as (1) individual characteristics and experiences, (2) behavior-specific cognitions and affect, and (3) behavioral outcome (Pender, Carolyn & Mary, 2014).

The first category of individual characteristics and experiences consist of prior related behavior and personal factors. Personal factors of PHPM include (1) biological factors such as age, gender, and body mass index, pubertal status ; (2) psychological factors, such as self-esteem, self-motivation and personal competence; (3) socio-cultural factors, such as race, acculturation, education, and socioeconomic status (Pender, Carolyn & Mary, 2014). The second category of behavior-specific cognitions and affects has components of perceived benefits of action, perceived barriers to action, perceived-self-efficacy, activity related affect, interpersonal influences, and situational influences (Pender, Carolyn &Mary, 2014).

Perceived benefits of an action are mental representations of the positive or reinforcing consequences of a behavior. An individual's expectation to engage in a particular behavior depends on the anticipated benefits. Perceived benefits are

proposed to, directly and indirectly, motivate behavior through determining the extent of a commitment to plan an action to engage in the behaviors (Pender, Carolyn & Mary, 2014).

Perceived barriers to an action consist of perceptions about the unavailability, inconvenience, expense, difficulty, or timing-consuming nature of a particular action. When barriers to action are high and the willingness is low, the expected behavior rarely takes place. On the other hand, when a barrier to action is low and the willingness is high, the expected behavior is likely to take place (Pender, Carolyn, Mary & 2014).

Perceived self-efficacy is the judgment of personal capability to organize and carry out a particular course of action. Self-efficacy does not involve skill but the judgment of what one can do with whatever skill one possesses. Feeling efficacious and skilled is likely to encourage one to engage in the target behavior more frequently influencing perceived barriers and determining the level of commitment to a plan of action (Pender, Carolyn & Mary, 2014).

Interpersonal influences such as social support from family, peers/friends, health providers, affect health promoting behavior directly or indirectly through social pressure, leading to performing a health-promoting behavior (Pender, Carolyn & Mary, 2014).

The third category is behavior outcome in the end point or action outcome attaining positive health outcomes. Health promoting behaviors, particularly when interpreted into a healthy lifestyle, result in improved health, enhanced functional ability, and better quality of life at all stages of development (Pender, Carolyn & Mary, 2014).

The framework of the PHPM consists of the three domains of individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcome. However, developing good behavior among older adults could be affected by several factors. Perceived benefits and perceived barriers are the components of behavior-specific cognitions which are the selected factors in this investigation of treatment adherence of promoting behaviors.

In this study, the researcher focuses on the factors of perceptions which are perceived benefits and perceived barriers of the older adults to treatment adherence. Perceived benefits improve treatment adherence through a positive behavior in which every patient engages in a benefit behavior through determining a commitment to a plan of action to engage in new behaviors. The expectation from the patient will result in a positive outcome (Pender, Carolyn & Mary, 2014). Perceived barriers will affect a patient's behavior through a loss satisfaction from promoting behaviors, which individuals can perceive barriers due to unavailability, inconvenience, and/or difficulty of a particular action.

Treatment Adherence Among Older Adults with Type 2 Diabetes Mellitus

Treatment adherence is important for older adults to maintain a normal level of blood glucose and to prevent complications (Asante, 2013).

Definition of treatment adherence among older adults with type 2 diabetes mellitus

Definition of treatment adherence with diabetes mellitus is the older adults are actively willingness and persisting with the four dimension of treatment adherence which is of the health care recommendations (Alikari & Zyga, 2014).

Goal of treatment adherence among older adults with type 2 diabetes mellitus

The goal of treatment adherence is glycemic control to avoid hyperglycemia and hypoglycemia and to prevent and manage complications of diabetes (Australia Diabetes Association, 2014) and to improve the older adults health behavior and well-being . HbA1c in type 2 diabetes mellitus patients is used for evaluating the history of long-term control diabetes. The general target of HbA1c in people with type 2 diabetes is HbA1c ≤ 7% (5 mmol/L) (American Diabetes Association, 2015).

Dimensions of treatment adherence

Treatment adherence can prevent the complications and improve the behavior of type 2 diabetes mellitus in older adults. The dimensions of treatment adherence consist of 4 dimensions; medication adherence, dietary behavior, physical activity, and the regular self-monitoring of blood glucose (Asante, 2013).

Medications. The first dimension is medication adherence**.** Medication is the administrating of medicine continuously from the first dose to the last dose of any medication to effectively control diabetes (Haynes, Yao, Degani, Kripalani & McDonald, 2005; Pourghazneina, Ghaffarib, Hasanzadeh & Chamanzari, 2013). The medications among older adults with diabetes type 2 are challenging because of the long duration and the complications of multiple prescriptions, and the deterioration of recognition and memory (Park et al, 2010). This is associated with defective glucose regulation leading to an increased risk of hyperglycemia and the presence of cognitive impairment, functional impairment, major comorbidities, and limited life expectancy (Inzucchi et al., 2012).

Medication uses oral hypoglycemic agents and insulin for the patients when lifestyle modification management cannot control their glycemic level and their conditions deteriorate (Williams & Pickup, 2004). Certain medications used in individual patients with type 2 diabetes mellitus are determined by medical judgment about the likely balance between ß –cell impairment and insulin resistance in patients' in regards to their particular conditions.

Oral type 2 diabetes mellitus are initiated at a low dose and titrated upwards based on the glycemic response. Insulin also is administered to type 2 diabetes mellitus patients with the following conditions (Krentz, 2005):

1. People with diabetes mellitus who failed to respond adequately to a combination of oral agents.
2. In people with combinations of oral drugs with worsens glycemic control.
3. Among patients during pregnancy , in patients with severe hepatic, and renal impairment.

Medication for type 2 diabetes mellitus, the following medications will be outlined : insulin secretagogues, an alpha-glucosidase inhibitor, and insulin sensitizers.

Insulin Secretagogues. Sulfonylureas are traditional antitype 2 diabetes mellitus drugs and have been used since the 1950s. Sulfonylureas work by lowering the blood glucose level primarily by stimulate the insulin secretion. Chlorpropamide (Diabinese) is the first-generation sulfonylurea. The second-generation of sulfonylureas are used in smaller doses than the first-generation drugs. The drugs are glipizide (Glucotrol and Glucotrol XL), glyburide (Micronized, Glynase, and Diabetes), and glimepiride (Amaryl) (Zhou, Mai, & Li, 2011).

These medicines generally are taken one to two times a day, before meals. All of these drugs have similar effects on blood glucose levels. This medicine is also preferred for patients who are not overweight. Sulfonylureas can also be used a combination with other classes of type 2 diabetes mellitus agents, with the exception of insulin secretagogues (Zhou, Mai, & Li, 2011). One of the most common effects with sulfonylureas is causing hypoglycemia. Severe hypoglycemia is likely with longer-acting sulfonylureas. Other adverse events include cutaneous sensitivity reactions (Luna & Feinglos, 2001).

Alpha-Glucosidase Inhibitor. Alpha-Glucosidase Inhibitor drugs are useful to lower blood glucose levels by blocking the breakdown of starches in the intestine. They inhibit the activity of α-glucosidase enzymes, which are responsible for the breakdown of carbohydrates to glucose and thereby reduce the rate of the digestion of carbohydrates (Nakamura, Kihara, Shimada, Fukuda, Watanabe, & Ito, 2014). Alpha-glucosidase inhibitor also can be used as a monotherapy which can be useful in blood glucose concentration and more marked postprandial hyperglycemia (Chipkin, 2005).

Insulin Sensitizers. For the overview of an insulin sensitizer, the contents are Biguanides, and Thiazolidinedione's (TZD).

Biguanides. The drug is Metformin (Glucophage) which improves the insulin sensitivity and lowers blood glucose concentrations without causing hypoglycemia. The effect of metformin also to lower the blood glucose levels by making muscle tissue more sensitive to insulin so glucose can be absorbed (Chipkin, 2005).

Thiazolidinediones (TZD). Thiazolidinediones increase insulin sensitivity via multiple actions on gene regulation. The effects due to the stimulation of a nuclear

receptor PPARγ. This receptor has the highest level in adipose tissue. Many of the genes activated by TZDs are involved in lipid and carbohydrate metabolism. The effects of adipose tissue increase the glucose level, fatty acid, and lipogenesis.

TZDs can be used as a fluid retention and decrease the hemoglobin concentration thus causing edema or anemia. The contraindications of TZDs are active liver disease and congestive heart failure (McCulloch, 2014).

Rosiglitazone. Rosiglitazone has an effect on total cholesterol level but decreases triglyceride concentrations. TZDs reduce the portion of smaller more iatrogenic low-density lipids (LDL) cholesterol (Tang, Norman, Balen, & Lord, 2003).

Dietary behavior. The second dimension is dietary behavior**.** Dietary behavior is concerned with the patient's access to have the right nutritious foods to meet his/her health and active lifestyle. Dietary behavior among older adults often needs more attention because of the limited taste and food preferences of older adults due to swallowing difficulties, poor dentition, or dentures that can cause discomfort when eating (American Diabetes Association, 2015).

Dietary behavior among older type 2 diabetes mellitus adults has become the frontline of diabetes management (William & Pickup, 2004), because dietary behavior and dietary behavior recommendations are important to control blood glucose levels, improve health status and prevent complications among type 2 diabetes mellitus patients (Wing et. al., 2001). To be effective in improving glucose control among type 2 diabetes mellitus patients, a good diet should provide sufficient calories to maintain an ideal body weight, and the diet should consist of complex carbohydrates and fiber, particularly fruits and vegetables, with lean proteins and 20% total fat (American Diabetes Association, 2015).

Successful dietary behavior therapy for diabetes mellitus patients depends on the sufferers' knowledge, their awareness of the implications, and their subsequent health behavior. By positively influencing type 2 diabetes mellitus patients individually, this can improve their behavior to enhance self-care which may significantly influence the success of the treatment for their diabetes (Albright, Parchman & Burge, 2001).

According to the American Diabetes Association (2015), the goals of dietary behavior therapy for diabetes is to improve the overall health of the patient especially to attain individualized glycemic, blood pressure, and lipid goals, achieve and maintain body weight goals, and delay or prevent any complications of diabetes. Type 2 diabetes mellitus patients should limit their intake of foods in regards to restricted foods that are high in saturated fat as found in many biscuits, cakes, pastries, pies, processed meats, commercial burgers, pizza, fried foods, potato chips, crisps, and other savory snacks. Foods and drinks containing added salt need to be limited; and foods and drinks containing added sugars are to be avoided. 'A nutritious diet that emphasizes complex carbohydrates and fiber, particularly fruits and vegetables, with lean proteins and 20% total fat should be effective in improving glucose control and reducing the need for medication (American Diabetes Association, 2015).

Physical Activity. The third dimension is physical activity. Physical activity is also an important part of treatment adherence and thus, essential to diabetes care in adult patients. The risks associated with physical inactivity in older adults can be significant because of the prevalence of atherosclerosis, coronary heart disease (CAD) and cerebrovascular disease among them (Meulemen et al, 2000). Physical activity is difficult for many older adults because of the decline in the muscle mass and general

mobility, strength, and energy. These problems may increase some risks for falls, injuries, and fractures because the muscles are getting weaker. Therefore, physical activity among older adults needs to be planned and safety should be considered. At least 30 minutes of physical activity per day and strength training physical activity helps maintain muscle mass and energy improves balance and well-being (American Diabetes Association, 2015).

Physical activity programs such as an exercise program should be designed based on the physical and physiological conditions of the older adults. Muscular strains, sprains, and injury to the feet or joints are of concern. Type 2 diabetes mellitus neuropathy, with the loss of sensation of pressure and pain, can result in foot injury from poorly fitting shoes, foreign objects and abnormalities in gait (Strauss, & Christensen, 2014). Physical activity that induces hypoglycemia is another potential risk, particularly in patients taking oral antihyperglycemic agents or insulin; therefore, the glucose lowering effects of physical activity should be assessed. In contrast, worsening hyperglycemia can occur during physical activity in patients whose glycemia is poorly controlled (American Diabetes Association, 2004).

Regular Self-monitoring of Blood Glucose. The fourth dimension is regular self-monitoring**.** This dimension is a necessity in the action to control glycemic levels, to predict complications from diabetes, to monitor responses to therapy, and to assess whether the target glycemic levels are being achieved (American Diabetes Association, 2015). Self-monitoring provides information and feedback that increase the awareness of the type 2 diabetes mellitus patient with the condition of his/her diabetes. Results of a study have indicated that the perceived benefits and barriers are associated with an awareness of a type 2 diabetes mellitus patient's condition.

Patient self-monitoring of blood glucose (SMBG) and HbA_1C measurements are the two primary ways to assess the effectiveness of a management plan on glycemic control (American Diabetes Associaton, 2008). Self-monitoring of blood glucose levels allows the patient to evaluate his/her individual response to therapy and assess whether the glycemic control is being achieved. Integrating SMBG results into diabetes management can be a useful tool for guiding medical dietary behavior therapy and physical activity, preventing hypoglycemia, and adjusting medications in particular prandial insulin doses) (American Diabetes Association, 2015).

HbA1C reflects average glycemia over several months and has a strong predictive value for diabetes complications. HbA_1C testing should be performed routinely in all patients with diabetes. Measurements approximately every 3 months determine whether a patient's glycemic target has been reached and maintained. Lowering HbA_1C to approximately 7% or less has been shown to reduce microvascular complications of diabetes and is implemented soon after the diagnosis of diabetes. Less stringent HbA_1C goals such as < 8 % may be appropriate for patients with a believe of barriers toward medication history of severe hypoglycemia, limited life expectancy, advanced microvascular or macrovascular complications (American Diabetes Association, 2015).

Measurements of treatment adherence

This section outlines the tools to measure treatment adherence. Medication is one of the important treatments for patients with diabetes mellitus. There are a variety of methods and tools to measure medications. to measure treatment adherence to medication There are three main methods of measuring medications to measure treatment adherence to medication. These are clinical self-report questionnaires, pill

counts, and the Morisky Medications Scale (MMAS) (Thompson, Kulkarni & Sergejew, 2000).

***Self-reporting*.** Methods for patient self-reporting include (1) patient-kept diaries (2) patient interview, with specific questions regarding the accuracy of medications (3) standard, validated, adherence specific questionnaires. (Farmer, 1999).

The self-reporting instrument has three sets of questions: four regimen screening items: two belief screening items; and two recall screening items. For the regimen screening items, each medication list consists of four questions: "How many days did you take it?", "How many times per day did you take it?'' "How many pills did you take a day?'' How many times did you miss taking a pill?'' Belief screening consists of two questions: "How well does this medication work for you "? " Does this medication work for you". Recall screening, consists of one question: "How hard is it for you to remember to take all the pills?" (Svarstad, Chewning, Sleath, & Claesson, 1999).

***Pill counts*.** A pill count is calculating the number of dosages like tablets, and capsules. This provides the amount of medication used by the patient during this time. The amount used is divided by the expected amount and multiplied by 100 to determine the percentage of compliance. For instance, a patient returns 12 tablets 30 days after receiving 60 tablets. The medication is taken twice daily; therefore, 60 units should be consumed over a 30-day period. The compliance ratio is then calculated as (60 - 12) / 60 x 100 = 80%. However, the use of pill counts to assess adherence has informational drawbacks. Even when accurate, pill counts can only document adherence as a percentage of total consumption. They cannot provide information

regarding the nature of the adherence problem (the pattern of missed doses) or the reasons for the problem (side effects) (Farmer, 1999).

Morisky Medications Scales (MMAS). MMAS is the subjective method of an adherence assessment tool in patients with diabetes was developed by Morisky in 1986. This is a multi-item scale consisting of 4 items that measure medication nonadherence in regards to the four patient-related barriers of forgetfulness, carelessness, feeling better and feeling worse. The reliability of this tool is low with a Cronbach's alpha of 0.61. The tool has been modified by Krousel Wood et al (2009).

The modified version of the MMAS consists of 8 items assessing the behavior of medication taking rather than the factors affecting adherence. The seven items in the questionnaire have replies in the dichotomy form of 'yes' or 'no'and one of the items (how often do you have difficulty in remembering to take medicines) is rated on 5-point Likert-type scale. The total score that can be obtained from the tool is 12 and the lowest score is 1. Higher score assumed better adherence to medication. Furthermore, the scores are categorized with 3 cut off points to interpret 3 levels of adherence which are low adherence (less than 6), medium adherence (6to 8) and high adherence (more than 8). The Cronbach's alpha was determined to be 0.83 for the new tool which is much better than the original one (Krousel-Wood et al., 2009).

Dietary behavior therapy as the second dimension can be measured by using the Dietary Behaviors Questionnaire developed by Schulundt (2003). The DBQ is comprised of 51 questions. The rating scale of the DBQ is a 4-Likert scale ("1" = Strongly disagree, "2" = Disagree, "3" =Neutral, "4" = Agree, and "5"= Strongly agree).

The total scores of the DBQ range from 33 to 132. The higher scores indicate better dietary behaviors. The reliability of the DBQ was tested using Cronbach's

alpha coefficient which is 0.73 and therefore, is considered as reliable for a newly developed instrument (Polit & Beck, 2008). The dietary behaviors are classified into three categories: low (score 33- 65.99), moderate (score 66-98.99), and high (score 99-132).

Physical activity as the third dimension can be measured by using the International Physical Activity Questionnaire (IPAQ) developed by Booth, Ainsworth, Pratt, Ekelund, Yngve, Sallis & Oja (2003). This questionnaire was designed to be used by adults aged 18-65 years. The short version (9 items) provides information on the time spent walking, in vigorous and moderate intensity and in sedentary activity. The long version with 31 items was designed to collect detailed information within the domain of household and yard work activities, occupational activity, self-powered transport, and leisure time physical activity. For the IPAQ scoring protocol, there are three levels of physical activity for classifying a population. The proposed levels are i "inactive", ii " minimally active", and iii " Hepa active"

Self-monitoring as the fourth dimension that can be measured using HbA_1C measurements approximately every 3 months which determine whether a patient's glycemic target has been reached and maintained. Lowering HbA_1C to approximately 7% or less has been shown to reduce microvascular complications of diabetes and is implemented soon after the diagnosis of diabetes. Less stringent HbA_1C goals such as < 8 % may be appropriate for patients with a history of severe hypoglycemia, limited life expectancy, and advanced microvascular or macrovascular complications (American Diabetes Association, 2015).

Treatment adherence measurement for patients with diabetes mellitus.

Treatment adherence in older adults with type 2 diabetes mellitus can be measured by the four dimensions consisting of medication adherence, dietary behavior , physical activity, and the regular self-monitoring of blood glucose using the Diabetes Compliance Questionnaire (DCQ) developed by Brooks (2002). DCQ assesses two areas of type 2 diabetes mellitus management: insulin administration and diet. The questionnaire consists of 9 items that require a response on a five-point Likert-type scale ranging from 5 (always) to 1 (never, and does not apply). The researcher has modified this questionnaire by choosing and adding more questions relevant to the definition of terms and the framework of this study. In this questionnaire the researcher has changed the term of insulin to medication as well as adding the other components of treatment adherence to this questionnaire.

The total items of this questionnaire are 20 items and each item consists of 4 components: medications, dietary behavior therapy, physical activity, and regular self-monitoring of blood glucose. The rating scale of the questionnaire is a 4 point Likert scale; Never, Occasionally, Sometimes, Always. The level of treatment adherence was categorized into three levels low (1.01-2.00), moderate (2.01-3.00), and high (3.01-4.00) (Brooks, 2002). The higher level indicates more adhere to treatment adherence.

Factors Related to Treatment Adherence

According to Pender, Carolyn, Mary (2014), there are several factors that predict behavior. The behavioral outcome in this study is treatment adherence. Factors related to treatment adherence with type 2 diabetes mellitus among these

associated factors are: (1) personal factors are categorized as biological factors such as age, gender, and body mass index, pubertal status; (2) psychological factors, (3) socio-cultural factors, such as race, acculturation, education, and socioeconomic status; (4) interpersonal factors, such as social support from family, peers/friends, health providers, the effect of health promoting behavior, directly or indirectly through social pressure, leading to the performance of a health-promoting behavior (Pender, Murdaugh & Parsons 2014).

Personal Factors. One study shows that age is related to treatment adherence. Better adherence has been shown by younger patients as being more adherent with medication than older adults are. This is because older adults tend to forget to take their medicine because of the process of aging they suffer impaired cognitive abilities, whereas younger adults have a better memory and are more active than older adults (Balkrishnan, Bole, Camacho, & Anderson, 2006).

Gender is another factor that influences behavior (Martin, Williams, Haskard & DiMatteo, 2005). A study indicated that men and women have different attitudes and behaviors related to diabetes care. Men and women have different orientations. Women are more sensitive to illness, are more able likely to rest during an illness, and are more willing to seek medical advice(Siddiqui, Khan, Carline, 2013).

Income/month is another factor to treatment adherence. The majority of older adults who do not adhere to treatment recommendations due to economic hardships cannot afford to pay for medical care services and neither can afford the recommended foods for type 2 diabetes mellitus (Manewo, Edward, Chideme-Munodawafa & Mandewo, 2014).

Religion is another factor to treatment adherence. Some patients are prohibited by their religion to use medical treatment or even alternative treatment.

This is identified as a barrier in that some patients are urged to discard their medication according to their religion. They are told that if they really believe in God they have to discard their medication and God will cure their diabetes. However, only a minority of religions teach this (Mandewo, Edward, Chideme-Munodawafa & Mandewo, 2014).

Psychological Factors. Psychological factors are also linked to regimen treatment adherence which can lead to stigmatization. A study reported the experience of stigma because of the dietary requirement of type 2 diabetes mellitus patients. One participant stated that others "make fun of his diet" (Vermeire et al., 2007). The experience of stigma can also affect the type of technology used by the type 2 diabetes mellitus patients. For instance, one individual in a study (Balfe & Jacksons, 2007) preferred injections to an insulin pump as she felt the pump would make her look "ugly". Additionally, 10 out of 12 participants in another study initially refused a changeover to insulin therapy after a recommendation from their doctor due to anxiety about the associated stigma (Tak-Ying Shiu, Kwan, & Wong, 2003). Thus, individuals with diabetes often experience stigma, which can affect diabetes treatment including dietary requirements and the use of technology. This often results in decreased adherence to treatment or non-adherence in order to avoid stigma.

Another researcher found higher levels of stress and maladaptive coping were associated with adherence problems. Psychological problems such as anxiety and depression are linked to worse conditions of diabetes (Jin, Sklar, & Li, 2008).

Social-cultural Factors. A study has found that there are gaps in the effects of race on adherence to oral anti-type 2 diabetes mellitus medications because each race has its own beliefs about consuming medicine (Peyrot, Rubin, Lauritzen, Snoek,

Matthews & Skovlund, 2005). Each culture has its own special foods as part of cultural traditions. Many cultures consume foods that are tasty and inexpensive to buy and prepare. Health care providers should understand their patient's cultural food traditions (Hildebrandt, Davis & Crandall, 2014).

Cultural of older adults lead to non-adherence include negative attitudes toward western medicine and exercise, cultural acceptance of obesity, general lack of social support for those with diabetes and overreaction to the potential side effects and denial of the disease arose as a potential barriers to patients as well as lack of understanding or forgetfulness due to additional regimens for co-morbidities (McGuire & Freyder, 2013). African American patients were reported to have difficulty establishing a trust relationship with health care providers due to their perception (Hildebrandt, Davis & Crandall, 2014). One cultural barrier is in relation to each culture having its own special foods as part of the tradition. Many cultures consume foods that are tasty and inexpensive to buy and prepare but are not necessarily good for them. Health care providers should understand their patients' cultural food traditions (Hildebrandt, Davis & Crandall, 2014).

Interpersonal factors. Interpersonal factors such as health care providers play an important role in treatment adherence (Delameter et al., 2001; Nagelkerk, Reick & Meengs ,2006). Several studies have shown that low levels of conflict, high levels of cohesion and organization, and good communication patterns are associated with better treatment adherence (Delameter et al., 2001). Another study by Nagelkerk, Reick, and Meengs (2006) has reported that family factors , especially family relationships play an important role in the self-management of dietary behaviors for patients with type 2 diabetes mellitus especially in the role of reminding them to consume medicine. Many adults with diabetes identify their spouse as very

important in buffering the emotional impact of diabetes, and in preventing depression or distress associated with diabetes.

Health care providers play an important role in achieving a good glycemic control of the type 2 diabetes mellitus patients through medications, as well as diet and weight control. Blood glucose control and the prevention of complications are among the key elements to success in diabetes care. In addition to the ability of the patients to obtain support from the health care provider team members, the quality of the patient-doctor relationship is also a very important determinant of treatment adherence (Aubert et al, 2002).

Perceived Benefits, Perceived Barriers and Treatment Adherence

Perceived benefits and perceived barriers are two variables that examine the relationship between treatment adherence.

Perceived benefits and treatment adherence

A perceived benefit is an action of an individual's perception or belief of a health promoting behavior that influences a person to engage a behavior. Perceived benefits directly motivate behavior through determining the extent of commitment to planning an action to engage in the behaviors. Individuals tend to invest time and resources in activities that have a high likelihood of positive outcomes. The benefits of a behavior may be intrinsic or extrinsic. Intrinsic benefits include alertness and energy and increased perceived attractiveness. Extrinsic benefits include monetary rewards or social health behavior. Extrinsic benefits may be highly significant, whereas intrinsic benefits may be more powerful in motivating the sustainability of health behaviors (Pender, Murdaugh & Parsons 2014).

In the majority of type 2 diabetes mellitus cases in regards to perceived benefits, respondents agreed with the statement that there are some benefits for adhering to treatment recommendations (medication, diet, and exercise) and they believed that following their prescribed treatment plans "would help them to stay well'' (Mandewo, Edward, Chideme-Munodawafa & Mandewo, 2014).

On the other hand, evidence suggests that family support from a family member can contribute to the deleterious effects of stress on glycemic control (Meyberry & Osborn, 2012). Patients with supportive families are more likely to have healthier behaviors, 'higher medication adherence and lower levels of stress that could explain their superior outcomes (Barcia-Huidbro, Bittner, Brahm & Puschel, 2011). Family relationships can be an important source of support for people with diabetes (Albright, Parachman & Burge, 2001).

Measurement of perceived benefits of type 2 diabetes mellitus

Perceived benefits are measured by using the questionnaire developed by Sechrist, Walker & Pender (1987). The questionnaire is an Exercise Benefits/Barriers Scale (EBBS) that was developed in response to a need for an instrument designed to determine the perceptions of individuals concerning the benefits and barriers to participating in the exercise. From the original questionnaire from Sechrist, Walker & Pender (1987), they only focused on exercise perceived benefits and perceived barriers, however, this is only one part of the dimension of treatment adherence.

The researcher has modified the questionnaire by selecting the questions that are relevant to the definition of terms and the framework of this study. The researcher has also divided each domain of treatment adherence into 4 parts of perceived benefits; perceived benefits of medications, perceived benefits of medical dietary

behavior therapy, perceived benefits of physical activity, and perceived benefits of regular self-monitoring blood glucose. The researcher has also modified the Likert scale from "Strongly Agree to Strongly Disagree " to "Never to Always" and the interpretation of the result. The total items of this questionnaire are 20 items and each item consists of 4 components: medications, medical dietary behavior therapy, physical activity, and the regular self-monitoring of blood glucose. The rating scale of the questionnaire is a 4 point Likert scale of Strongly disagree, Disagree, Agree, Strongly Agree. The level of treatment adherence low level (1.00 -2.00), moderate level (2.01-3.00), and high (3.01-4.00) (Brooks, 2002) . The higher scores indicate higher positive perceptions.

Perceived barriers and treatment adherence

Perceived barriers to an action is a perception of blocks, hurdles, and personal costs of undertaking a health behavior (Pender, 2011). Barriers usually arouse motives to a given behavior, and anticipated barriers have been repeatedly found to affect intentions to engage in a particular behavior. Perceived barriers to performing an action affect health-promoting behavior directly by serving blocks to the action as well as indirectly through decreasing levels of commitment to a plan of action (Pender, Murdaugh & Parsons 2014). There are several causes of perceived barriers to type 2 diabetes mellitus treatment adherence which include medications, dietary behavior, physical activity, self-monitoring, economic hardships, religion, culture, and family support. These perceived barriers are described below.

Medications Barriers. Low medication adherence has become a health care issue that greatly affects the health of older adults (Mahesh & Parthasarathi, 2004). The risk factors confirmed by these studies include age, financial difficulty, ethnicity

psychological factors, social support, and the quality of the relationship between a patient and physician (Tiv, Viel, Mauny, Eschwege, Will, Fournie & Penformis (2012). Perceived barriers to medications among older adults are: forgetting to consume the medication at the right time, taking too many drugs per day because of forgetting the medication instructions, being away from home (for example, going on trips, attending funerals, and meetings), and financial constraints (Mandewo, Edward, Chideme-Munodawafa & Mandewo, 2014).

A number of older adults with diabetes fail to adhere to treatment recommendations in regards to the use of insulin because they live without other family members. They do not have anybody to help them with the medical procedures of insulin use. This may also cause older adults to take less than the prescribed amount or overdose resulting in them being admitted to hospital. Other barriers are the lack of standardized syringes which may lead to wrong dosages, and financial constraint (Mandewo, Edward, Chideme-Munodawafa & Mandewo, 2014).

Dietary behavior. Many populations face barriers in implementing healthy lifestyle habits, especially in regard to dietary adherence. These barriers included limited access to healthy foods and supermarkets (Russel et al., 2010). For instance, in the neighborhoods with small grocery stores, there is limited access to whole grains and low-fat products (Jetter & Cassaday, 2006). Apart from availability, the cost is also a barrier to healthy food choices. There is often higher costs associated with healthier food (Harrisson et al., 2007). While a person's geographical environment contributes significantly to their eating choices, their social environment plays an important role as well. Dietary behavior is susceptible to social influences, which can be either positive or negative (Gellat et al., 2007).

The barriers in practicing good dietary behavior therapy among older adults are limited taste and food preferences due to swallowing difficulties, limited food supply, poor self-control, discomfort when eating, difficult to change dietary habits, feeling stress or depressed, and multiple health problems (Mandewo, Edward, Chideme-Munodawafa & Mandewo, 2014). Another barrier to dietary changes is simply that the food is hard to prepare. For example, a lack of time is a common reason for deterring people from preparing fruits and vegetables. In other words, many patients have a misunderstanding about what qualifies as a healthy meal.

Physical Activity Barriers. Physical activity has been shown to improve glycemic control as measured by hemoglobin (HbA1c). Physical activity is an important factor in reducing morbidity from diabetes and maintaining the quality of life. However, physical activity is encouraged for the long term and this is the major problem with performing physical activity. Many patients fail to maintain self-motivation, and environmental barriers have been associated with the failure to maintain physical activity (Thomas, Alder, & Leese, 2004).

Lack of confidence in the ability to perform physical activity was the main barrier in performing physical activity providing encouragement to patients to do physical activity is important. It has previously been suspected from indirect associations, there is an association between television viewing and inactivity. It is unfortunate that television viewing has such a detrimental effect on the health of the nation, and it is a difficult barrier to overcome where older adults prefer watching television shows rather than exercising (Thomas, Alder, & Leese, 2004).

Mandewo, Edward, Chideme-Munodawafa, and Mandewo (2014) reported the results of their study on non-adherence to treatment adherence among type 2 diabetes mellitus adults in Zimbabwe. The results of their study indicated that the perceived

barriers to physical activity among adults and older type 2 diabetes mellitus adults were a lack of information and written instruction on how exercises should be done, body pain, physical weakness, ageing, sickness, being too busy, worsening illness, poor motivation, and forgetting to do physical activity. Physical activity can also be difficult for many older adults because of the decline in the muscle mass and general mobility, strength, and energy. These factors may increase some factors like falls, injuries, and fractures. In general, a physical activity program can be safe and beneficial if it is carefully constructed and supervised to account for the physical and psychological capabilities of the patient (American Diabetes Association, 2015).

A study was done in the USA to explore the perceived barriers to physical activity among older adults in the population of African American women. The results of this study show that the subjects experienced barriers of limited time, fatigue, demanding family responsibilities, and low motivation (Williams et al., 2006). Another study also in the USA explored the group of women such as Latina and American Indian women. It was discovered that the most common perceived barriers to physical activity were fatigue, lack of energy, the role of responsibilities, and personal health factors (Juarbe, Turok & Pérez-Stable, 2002).

Regular Self-Monitoring Blood Glucose Barriers. A study about the barriers and facilitators to the self-monitoring of blood glucose (SMBG) in people with type 2 diabetes demonstrated a range of perceived barriers to their utilization of SMBG. These included the cost of test strips and needles; frustration related to high blood glucose readings; the perception that SMBG was only for insulin titration; stigma; fear of needles and pain; inconvenience; unconducive workplace; lack of motivation; and lack of knowledge and self-efficacy (Ong, Chua & Ng, 2014).

Knowing his/her blood glucose level serves as a reminder that he/she has type 2 diabetes mellitus. However, this state of awareness can lead type 2 diabetes mellitus patients to experience feelings of a loss of self, loss of autonomy, loss of self- esteem and the need to face struggles as they work to improve their health but at the same time creates distress and thus becomes the perceived barrier (Dlugasch & Ugarriza, 2014). Another study was done by Chlebowy, Hood, & LaJoie, (2010) reported that the barriers to self-monitoring with type 2 diabetes mellitus are; lack of family support, family pressure, lack of provider empathy concerning their fear of diabetes complications.

Measurement perceived barriers of type 2 diabetes mellitus

Perceived benefits are measured by using the questionnaire developed by Brooks (2002). The questionnaire is the barriers to self-care scale (BSCS) which is used to perceived barriers to the treatment of type 2 diabetes mellitus and their relationship to adherence. This questionnaire consists of 31 items which measure the patients' perceptions in regards to their concern about treatment regimen. The regimen areas evaluated are diet, exercise, glucose testing, and medication taking. The researcher modified this questionnaire by not using all of the items from the original questionnaire. The items that were selected are relevant to the definition of terms and the framework of this study. The researcher has modified the Likert scale from "very rarely" to " never" as well as the interpretation of the results. The total number of items of this questionnaire is 20 items and each item consists of 4 components: medications, medical dietary behavior therapy, physical activity, and regular self-monitoring of blood glucose. The rating scale of the questionnaire is a 4 point Likert scale of Strongly disagree (SD), Disagree (D), Agree (A), Strongly Agree (SA). The

level of treatment adherence low level (1.00-2.00), moderate level (2.01-3.00), and high (3.01-4.00) (Brooks, 2002). The higher level indicates higher negative perceptions.

Summary of The Literature Review

The literature review of this study provides information related to the overview of diabetes mellitus in older adults, the health care services in Indonesia for type 2 diabetes mellitus care, perceived barriers, perceived benefits of treatment adherence, the Pender's health promotion model, treatment adherence among older adults with type 2 diabetes mellitus, and the factors related to treatment adherence.

The number of patients with diabetes mellitus in Indonesia increases each year. Therefore, treatment adherence is important to prevent any complications of diabetes mellitus. The dimension of treatment adherence consists of medication, diet, physical activity, and self-monitoring. Patients who have diabetes mellitus must adhere to their treatment. Research has shown that a significant portion of type 2 diabetes mellitus patients fails to adhere to their treatment.

According to the health promotion model, an individual health-promoting behavior is influenced by several factors consisting of individual characteristics and experiences, behavior-specific cognition including perceived benefits, perceived barriers, perceived self-efficacy, activity related affect, interpersonal influences, situational influences and behavioral outcome. All of the factors have a direct and indirect effect on treatment adherence. Perceived benefits and perceived barriers, which are the components of behavior specific cognition and affect, were selected to be investigated in relation to treatment adherence.

Chapter 3

Research Methodology

Chapter three describes the research design, population and setting, sample and sampling, instruments, ethical consideration, data collection, and the data analysis of this study.

Research Design

This research design was a descriptive correlational study. The aim of this study was to identify the level of perceived benefits, perceived barriers, and treatment adherence among older adults with type 2 diabetes mellitus and to examine the relationship between perceived benefits, perceived barriers and treatment adherence among older adults with type 2 diabetes mellitus.

Population and Setting

This study was conducted among 164 older adults with type 2 diabetes mellitus aged 60 years or older who are members of the Indonesian Diabetes Association called PERSADIA, at Bandar Lampung city chapter. PERSADIA is an association organized for diabetics. The PERSADIA group of health care providers consists of medical doctors, nurses, and nutritionists. Each part of PERSADIA provides care and regular health education activities to its members. PERSADIA in Bandar Lampung provides services every day of the week from 8 am to 5 pm.

Samples

The number of samples in this study were estimated based on using the power analysis from the previous study of Primanda, Kritpracha, and Thaniwattananon,

(2011), which examined the relationships between selected factors and dietary behaviors among type 2 diabetes mellitus patients in Yogyakarta, Indonesia. The study showed that there were positive significant relationships between the knowledge regarding a diabetic diet and the dimensions of recognizing the amount of calorie need (r = .27, p< .05). According to Polit and Beck, 2012 (table 17.7 on p. 425), when estimating the population coefficient correlation, r = .25 is used to achieve the power of .90 at .05 level of significance, therefore the required sample size is 164.

Sampling Method

The purposive sampling was used to recruit eligible participants. The inclusion criteria were:

1. Age 60 years or older who are members of Indonesia Diabetes Association called PERSADIA, Bandar Lampung, West Sumatera, Indonesia
2. Only consuming oral medications.
3. Has been diagnosed with type 2 diabetes mellitus at least one year.
4. Those who are willing to participate in this study.
5. Able to communicate verbally or writing in the Indonesian language.

Data Collection Instruments

The data collection tools included 4 parts; (1) demographic and health information data, (2) perceived benefits of type 2 diabetes mellitus treatment adherence questionnaire, (3) perceived barriers of type 2 diabetes mellitus treatment adherence questionnaire, and (4) treatment adherence questionnaire.

Part 1. Demographic and Health Information Form . The researcher developed the Demographic and Health Information (DHI). The DHI was used to gather the following data: age, gender, religion, level of education, marital status, occupation, income/month, accessibility health service, age of onset, duration, medication used, number of family members, family history of diabetes mellitus,diabetes education, comorbidities, blood glucose level, medical diagnosis. The data on current medication and latest fasting blood glucose (FBG) was collected from the patients' medical records.

*Part 2. Perceived Benefits of Type 2 Diabetes Mellitus Treatment Adherence Questionnaire***.** Perceived benefits can be measured by using a questionnaire developed by Sechrist, Walker, and Pender (1987). The questionnaire is an Exercise Benefits/Barriers Scale (EBBS) that was developed in response to a need for an instrument designed to determine the perceptions of individuals concerning the benefits and barriers to participating in the exercise. The original questionnaire has 24 items and the instrument has a four-response, forced-choice Likert–type format with responses ranging from 4 (strongly agree) to 1 (strongly disagree). When the benefits scale is used alone, scores range between 24-96 and the higher the score on the benefits scale, the greater the perception of benefits to exercise. The researcher modified the questionnaire by adding the components on medications, dietary behavior, and regular self-monitoring of blood glucose. Each component was developed considering the relevance to the definition of the terms and the framework of this study. The total number of items of this questionnaire is 18 consisting of the 4 components of:

1. Medication adherence (item1,2,3,4,5)
2. Dietary behavior (item 6,7,8,9)

3. Physical activity (item 10,11,12,13,14)
4. Regular self-monitoring of blood glucose (item 15,16,17,18)

The rating scale of the questionnaire is a Likert 4-scale scored from 1 to 4 in terms of 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree. The level of perceived benefits was categorized into three levels (Brooks, 2002):

1. Low: 1.00-2.00 Older adults has low level of perceived benefits
2. Moderate: 2.01-3.00 Older adults has moderate level of perceived benefits
3. High: 3.01-4.00 Older adults has high level of perceived benefits

With a higher level indicating higher perceived benefits toward treatment adherence. Which means the lowers the level of perceived benefits the lower older adults perceived to treatment adherence.

Part 3. Perceived Barriers of Type 2 Diabetes Mellitus Treatment Adherence Questionnaire. Perceived barriers can be measured by using a questionnaire developed by Sechrist, Walker & Pender (1987). The questionnaire is an Exercise Benefits/Barriers Scale (EBBS) that was developed in response to a need for an instrument designed to determine the perceptions of individuals concerning the benefits and barriers to participating in the exercise. The original questionnaire has 43 items and has four-response, forced-choice Likert–type format with responses ranging from 4 (strongly agree) to 1 (strongly disagree). Barriers scale items are reverse-scored. Items on the barriers scale are numbers 4, 9, 12, 14, 16, 19, 21, 24, 28, 33, 37, 40, and 42. Scores on the total instrument can range from 43-172. In this instance, the higher the score on the barriers scale, the greater the perception of barriers to exercise.

The researcher modified the questionnaire by adding the components on medications, dietary behavior, and regular self-monitoring of blood glucose by using

the questionnaire developed by Brooks (2002). The questionnaire is on the barriers to self-care scale (BSCS) and was used to identify perceived barriers to the treatment of type 2 diabetes mellitus and their relationship to adherence. The 31 items of this instrument measure the patient's perceptions of his/her concerns about the treatment regimen, which may be different from the concerns identified by health care providers. The items of this instrument are diet, exercise, glucose testing, and medication taking.

Each component was modified considering the relevance to the definition of terms and the framework of this study. The total number of items of this questionnaire is 20 consisting of the 4 components of:

1. Medication adherence (item 1,2,3,4,5)
2. Dietary behavior (item 6,7,8,9,10)
3. Physical activity (item 11,12,13,14,15)
4. Regular self-monitoring of blood glucose (item 16,17,18,19,20)

The rating scale of the questionnaire is a Likert 4-scale scored from 1 to 4 in terms of 1 = Strongly Disagree, 2 = Disagree, 3 = Sometimes, 4 = Always. The level of perceived barriers was categorized into three levels (Brooks, 2002):

1. Low: 1.00-2.00 Older adults has low level of perceived barriers
2. Moderate: 2.01-.3.00 Older adults have moderate level of perceived barriers
3. High: 3.01-4.00 Older adults has high level of perceived barriers

With higher level indicating higher perceived barriers toward treatment adherence. Which means the lower of the level the fewer barriers toward treatment adherence.

Part 4. Treatment Adherence Questionnaire. Treatment adherence in older adults with type 2 diabetes mellitus can be measured by the four dimensions consists of medications, dietary behavior, physical activity, and regular self-monitoring of blood glucose using the Diabetes Compliance Questionnaire (DCQ) developed by Brooks (2002). The questionnaire consists of 9 items that require a response on a five-point Likert-type scale ranging from 5 (always) to 1 (never and does not apply). The researcher modified the questionnaire by adding more components on physical activity and regular self-monitoring of blood glucose which are considered relevant to the definition of terms and the framework of this study. The questionnaire was modified by changing the terms of insulin to medication and diet to dietary behavior. The total items of this questionnaire are 20 items and each item consists of 4 components:

1. Medication adherence (item 1,2,3,4,5)
2. Dietary behavior (item 6,7,8,9,10)
3. Physical activity (item 11,12,13,14,15)
4. Regular self-monitoring of blood glucose (item 16,17,18,19,20)

The rating scale of the questionnaire is a Likert 4-scale scored from 1 to 4 in terms of 1 = Never, 2 = Occasionally, 3 = Sometimes, 4 = Always. The level of treatment adherence was categorized into three levels (Brooks ,2002) :

1. Low: 1.00-2.00 Older adult has low level of treatment adherence
2. Moderate: 2.01-3.00 Older adults has moderate level of treatment adherence
3. High: 3.01-4.00 Older adults has high level of treatment adherence

A Higher level indicates higher of treatment adherence. Which means the higher the level of older adults the more they adhere to the treatment of diabetes mellitus.

Validity and Reliability of the Instruments

In this study, the original instruments were modified in order to fit the conceptual framework of the study and each of these instruments was tested for validity and reliability.

The validity of the Instruments.

The content validity for the questionnaire development perceived benefits of type 2 diabetes mellitus treatment adherence, perceived barriers to type 2 diabetes mellitus treatment adherence, and treatment adherence of type 2 diabetes mellitus patients were examined by three experts: (1) an academic staff member of the Faculty of Nursing, Prince of Songkla University, Hatyai, Thailand expert in Cardiovascular in terms of treatment adherence (2) physician and chairperson, Indonesian Diabetes Association, Bandar Lampung Chapter (3) a diabetes educator, Faculty of Nursing, Universitas Advent Indonesia. The researcher corrected the instruments based on the experts' recommendations.

Reliability of Instruments.

After assuming the validity of the instruments, a test for reliability was conducted among the older adults with type 2 diabetes mellitus. The older adults were recruited from the membership of Bandar Lampung PERSADIA. The reliability of the questionnaires was tested with around 30 older adults with type 2 diabetes mellitus.

The internal consistency of the questionnaires was tested by calculating Cronbach's alpha. The results of Cronbach's alpha for perceived benefits, perceived barriers, and treatment adherence were .92, .81, and .82.

Translation of the Instruments

The questionnaires were originally developed in English. However, to be used in the data collection process in Indonesia, the instruments were translated into the Indonesian language. The instruments were translated from English into Indonesian language using the back-translation technique. The first bilingual translator translated the English version into an Indonesian version. The second bilingual translator translated back the instruments from the Indonesian version into an English version. The third bilingual translator then clarified and identified any differences in the items of both versions.

Ethical Consideration

This study was conducted with the full intention to protect the human rights of all participants. The study proposal was submitted to the Ethics Committee of the Faculty of Nursing, Prince of Songkla University, for approval prior to data collection. Permission was also sought from the head of the chair of Bandar Lampung PERSADIA. Then, the researcher explained to the participants the details of the study including the objectives of the study, the procedures, and the possible benefits and risks of the study to the participants. All of the participants received the information that they have the right to choose whether they want to participate in the program and that they can withdraw from this program at any time without any

negative consequences. The participants conveyed their agreement to participate in the study verbally by writing inform consent (Appendix A).

Data Collection Methods

Data collection was conducted in Bandar Lampung, West Sumatera, Indonesia from February 2016 to April 2016. Data collection procedures were done in two phases: 1) preparation phase and 2) implementation phase.

Preparation Phase

During the preparation phase the researcher did the following steps:

1. Asked for permission to collect data by submitting a letter to the Faculty of Nursing Prince of Songkla University, Hatyai, Thailand and to Bandar Lampung PERSADIA.

2. Sent a letter of request to the chair of Bandar Lampung PERSADIA where the researcher conducted the study, to obtain permission to collect data on the participating members.

3. Informed the doctors, head nurses, and staff nurse in PERSADIA Bandar Lampung about the purpose, procedure, and time of the study.

4. Prepared all the instruments required such as the questionnaires for demographic and health information form (DHI), perceived benefits questionnaire, perceived barriers questionnaire, and treatment adherence questionnaire and informed consent.

5. Tested the validity, and the reliability of the instruments and conducted a pilot study.

Implementation Phase

After receiving the necessary approval from all parties concerned, the researcher went to Bandar Lampung PERSADIA for data collection.

1. Firstly, approval by nurses and ask for them permission they could meet and the participants based on inclusion criteria contacted by the nurse in PERSADIA.

2. After consent to join the study had been obtained from the participants, the researcher invited them to attend a meeting for a briefing on the study. During the briefing, the researcher introduced himself and explained the objectives of the study.

3. The informed consent form was read and explained to the participants and signed by both the researcher and participants. The copy of the form was also provided to every participant. All the components of ethical consideration were strictly followed. After the participants had signed the informed consent form and were comfortable and ready, the required information was obtained through the filling-in of the questionnaires.

4. During the data collection, the demographic data form was administered to the participants. Before filling in the questionnaire, the researcher check the data form of the lab for each participant that the participants are allowed to after filling in demographic data, the perceived benefits, perceived barriers, and treatment adherence questionnaire. The researcher checked the completion of the questionnaires at the end.

5. The subjects who were not able to read because of eye problems were helped by the researcher in filling in the questionnaire. There were 50 participants who could not fill in the questionnaires by themselves This process continued until the sample size was reached.

Data Analysis

To analyze the data to answer the research question, descriptive and inferential statistics were used in the following way:

1. Descriptive statistic was used to analyze and describe the demographic characteristics, the level of perceived benefits and perceived barriers and the treatment adherence of older adults and frequencies, percentage, mean, and the standard deviation was calculated.

2. Pearson's correlation was used to analyze the relationship between perceived benefits, perceived barriers, and treatment adherence.

3. Before using Pearson's correlation, the test of assumption for correlation was examined between the independent variable perceived benefits, perceived barriers, and dependent variable- treatment adherence with the help of testing for normality, linearity, and homoscedasticity. The assumption of normality was tested by using Skewness and Kurtosis test to see data is normal must divide score by its standard error and the result is ± 3, it is suggested that the data are normal. The assumption of linearity and homoscedasticity was tested by the scatter plot.

Chapter 4

Result and Discussion

Chapter four presents the results of the study and discussion of the findings as follows: 1) participants' characteristics, 2) level of perceived benefits, perceived barriers,and treatment adherence 3) relationship between perceived benefits, perceived barriers and treatment adherence.

Results

Patients' Characteristics

The participants' characteristics are presented in Table 1. The majority of the participants (72 %) were aged 60 – 69 years old with a mean age of 64.13 (*SD* = 4.42), and 80.5 % of the participants were female. The majority of the participants (90.2 %) were Muslim and 34.1 % of the participants had an education status of high school level. The married participants made up 93.9 % of the total amount of participants. Exactly 42.7% of the participants were retirees. In terms of income, 25.6 % of the participants had an income between 1,000,001-2,000,000 IDR/month, which is equivalent to 2,600 – 5,300 THB and more than half (73.2 %) of the participants considered their income to be sufficient.

Table 1

Frequencies and Percentages of Participants' Demographic Characteristics (N = 164)

Characteristics	*n*	%
Age (Overall *Mean*= 64.13, *SD* = 4.42, *Min*= 60, *Max*= 82)		
60 – 69	118	72.0
70 – 79	30	18.3
>80	16	9.7
Gender		
Male	32	19.5
Female	132	80.5
Religion		
Muslim	148	90.2
Catholic	8	4.9
Christian	7	4.3
Hindu	1	0.6
Education Status		
No formal education	1	0.6
Elementary Level	37	22.6
Junior high school level	37	22.6
High school level	56	34.1
University	33	20.1
Marital Status		
Married	154	93.9
Divorced/Widowed	10	6.1
Occupational		
Private	64	39.0
Government	21	12.8
Retired	70	42.7
None	9	5.5
Income/Month		
< Rp 500,000	18	11.0
Rp 500,001-1,000,000	35	21.3
Rp 1,000,001-2,000,000	42	25.6
Rp 2,000,001-3.000.000	37	22.6
> Rp 3,000,001	32	19.5
Enough	120	73.2
Not Enough	44	26.8

Table 2. More than half of the participants (52.4 %) reported that the health care center was the most accessible health service. In terms of duration of diabetes mellitus, the highest duration fall into the range of 1-10 years (68.3 %). The majority of the participants (82.3 %) consumed Biguanides a class of medicine for diabetes medication. Most of the participants (65.2 %) consumed combined dosage of diabetes mellitus medicine. The number of family members ranging from 1 to 5 persons was found in 88.4 % of the participants. In terms of family history for diabetes mellitus, 25.6 % of the participants reported having a mother who suffered from diabetes. Most of the participants (34.8 %) had their food prepared by their daughter at home. The majority of the participants (91.5 %) had received diabetes education. Most of the participants (75.5 %) reported having fasting blood glucose more than < 154 mg/dl and more than half of the participants 59.4 % of the participants who checked for random blood glucose <200 mg/dl. As many as 55.5 % of the participants had comorbidities of high blood pressure (28.0 %), heart disease (9.8%), high blood lipids (23.2 %), and other diseases (17.0%).

Table 2.

Frequencies and Percentages of Participants"Health Information" (N = 164)

Characteristic	*n*	%
Accessible Health Services		
Health Care Center	86	52.4
Hospital	78	47.6
Age at Onset of the Disease (in Years) (Overall *Mean*= 1.3 years, *SD* =.59, *Min*= 1, *Max*= 31)		
1-10	112	68.3
11-20	44	26.8
21-30	7	4.3
31	1	.6
Type 2 Diabetes Mellitus Drugs		
Biguanides		
Yes	135	82.3

Table 2 Continue

Characteristic	*n*	%
No	29	17.7
Alpha-Glucosidase Inhibitor		
Yes	2	1.2
No	162	98.8
Thiazolidinediones (TZDs)		
Yes	5	3.0
No	159	97.0
Insulin		
Yes	2	1.2
No	162	98.9
Dosage of Medine		
Single	107	65.2
Combine	57	34.8
Number of Family		
1-5	145	88.4
6-10	18	11.0
None	1	0.6
Family History of Diabetes Mellitus		
None	34	19.9
Grandfather	15	2.9
Grandmother	17	9.9
Father	59	34.5
Aunt	41	24.0
Mother	12	7.0
Uncle	3	1.8
Diabetes Education		
Yes	150	91.5
No	14	8.5
Comorbidities		
Yes	91	55.5
No	73	44.5
Hypertension		
Yes	46	28.0
No	118	44.5
Heart disease		
Yes	16	9.8
No	148	90.2
High cholesterol		
Yes	38	23.2
No	126	76.8
Other Disease	29	17.0
Blood Glucose Level		

Table 2 Continue

Characteristic	*n*	%
Fasting Blood Glucose (n = 100, Overall *Mean* = 144 mg/dl, *SD* = 55.7, *Min*. = 70 mg/dl, *Max* = 450 mg/dl)		
≤154 mg/dl	75	75.0
≥155 mg/dl	25	25.0
Random Blood Glucose, (n = 64, Overall *Mean* = 190 mg/dl, *SD* = 79.8, *Min* = 89 mg/dl, *Max* = 435 mg/dl)		
<200mg/dl	38	59.4
>201mg/dl	26	40.6

Level of Perceived Benefit, Perceived Barriers, and Treatment Adherence

The level of perceived benefits, perceived barriers, and treatment adherence scores are summarized in Table 3. Overall, the level of perceived benefits was at a high level (*Mean* = 3.23, *SD* = .66). From the four domains of perceived benefits the highest section belongs to physical activity (*Mean* = 3.33, *SD*= .05) and the lowest section belongs to self-monitoring (*Mean* = 3.01, *SD* = .47) .

Overall, the level of perceived barriers were at a low level (*Mean* = 1.81, *SD* = .73), the highest section belong to regular self-monitoring (*Mean* = 1.92, *SD* = .39) and the lowest section belongs to medication adherence (*Mean* = 1.65, *SD* = .16).

Overall, the level of treatment adherence was at a moderate level (*Mean* = 2.83, *SD* = .80). From the four domains of treatment adherence, the highest sections belong to medication adherence (*Mean* = 3.05, *SD* = .27) and the lowest section belongs to self-monitoring (*Mean* = 2.47, *SD* = .55).

Table 3.

Level of Mean,Standard Deviation of Perceived Benefits, Perceived Barriers, and Treatment Adherence

Variables	Min-Max		*M*	*SD*	Level
Perceived benefits					
Medication Adherence			3.31	.08	High
Dietary Behavior			3.30	.10	High
Physical Activity			3.33	.05	High
Regular Self Monitoring Blood Glucose			3.01	.47	High
Overall	3.01	3.33	3.23	.66	High
Perceived barriers					
Medication Adherence			1.65	.16	Low
Dietary Behavior			1.86	.18	Low
Physical Activity			1.80	.09	Low
Regular Self-monitoring blood Glucose			1.92	.39	Low
Overall	1.65	1.92	1.81	.73	Low
Treatment adherence					
Medication Adherence			3.05	.27	High
Dietary Behavior			2.87	.52	Moderate
Physical Activity			2.87	.23	Moderate
Regular Self-Monitoring Blood Glucose			2.47	.55	Moderate
Overall	2.47	3.05	2.83	.80	Moderate

Relationship Perceived Benefits, Perceived Barriers, and Treatment Adherence

The relationship between perceived benefits and treatment adherence of the subjects is presented in table 4. The results of the correlation showed that there was a significant positive correlation between perceived benefits and treatment adherence ($r = .690$, $p < 0.001$).

The relationship between perceived barriers and treatment of the subjects is presented in table 4. The results of the correlation showed that there was a

significantly negative correlation between perceived barriers and treatment adherence (r = -.453, $p < 0.001$).

Tabel 4 Relationship Between Perceived Benefits, Perceived Barriers, and Treatment Adherence (N=164).

Factors	1	2	3
1. Perceived Benefits	1	-.529**	.690**
2. Perceived Barriers	-.529**	1	-.453**
3. Treatment Adherence	.690**	-.453**	1

Note. 1. Perceived Benefits, 2. Perceived Barriers, and 3. Treatment Adherence

** P <0.001

Discussion

This section presents the discussion of the findings corresponding to the research objectives. The objectives of this study were to describe the level of perceived benefits, perceived barriers and treatment adherence and the relationship between perceived benefits, perceived barriers and treatment adherence among Indonesian older adults with type 2 diabetes mellitus. One hundred and sixty-four participants were recruited in PERSADIA Bandar Lampung, Indonesia. The findings follow three main parts: 1) demographic characteristics and health information, 2) level of perceived benefits, perceived barriers, and treatment adherence, 3) the relationship between perceived benefits, perceived barriers, and treatment adherence.

Demographic Characteristics

The majority of the participants (80.5 %) with diabetes were female. The reason the prevalence of a female was higher than male because the female has a higher prevalence of obesity than male and had lower physical activity among female than male (Scavini, Stidley, Shah, Narva, Tentori, Kessler &Natachu 2003). This finding was similar to the earlier study on diabetes in Indonesia that reported 54.3% were female (Primanda, Kritpracha & Thaniwattananon, 2011). Another study from Scavini, Stidley, Shah, Narva, Tentori, Kessler, and Natachu (2003) had found that the prevalence diagnosed with diabetes among Zuni Indians was higher among female Zuni Indians (16.7%) than Male Zuni Indians (9.7%).

The highest portion of the participants (87.2%) of the participants belonged to the Muslim religion. The high percentage of Muslim in this study due to the high percentage of people in the general population of Indonesian population were

Muslim. In Indonesia 95 % of the population is Muslim (Badan Pusat Statistic, Sensus Penduduk, 2016). This data was also supported by Primanda, Kritpracha & Thaniwattananon, (2011) in that the religion of 90.2 % of the participants was Muslim.

In this study, most of the participants (34.1 %) had an education level of high school. In Indonesia, compulsory education only goes to high school level (Badan Pusat Statistik, 2015). Most of the participants (93.9 %) in this study were married. In Indonesia, more than half than the population were married (Badan Pusat Statistic, Sensus Penduduk, 2016). A previous study from Primanda, Kritpracha & Thaniwattananon, (2011) mentioned that majority of the participants were married and most of the participants (25.6 %) in this study had an income of Rp.1,000,001-2,000,000/month. Most of the participants (73.2 %) mentioned that they had enough income/month, which could be due to most of the participants (42.7 %) were retired and (70.2%) living with their families. In Indonesia, most of the older adults who are retired live with their sons or daughter because those who are retired only get a little money from the government and their sons or daughters will financial support them (Badan Pusat Statistic, Sensus Penduduk, 2016).

The mean length of time since the diagnosis of diabetes mellitus in this study was 1.3 years. The finding reflected the early period of diabetes case finding which could be explained that the Indonesian Endocrinology Society (Perkeni) the Indonesian Diabetes Association (PERSADIA) had implemented a series of programs to increase the awareness of diabetes disease. The program started in 2010 and focuses on the interventions program of diabetes and was screening to identify people at risk of diabetes mellitus such as hypertension is the most efficient way to ensure

diabetes mellitus is identified and treated early. Thus, concomitant screening of at-risk populations for diabetes is essential this leads to an early period of diabetes case in Indonesia (Soewondo, Ferrario, & Tahapary, 2013).

These findings were similar to the previous study of Wandell and Gafvels, (2004) that the length of time of participants in their study had been diagnosed with diabetes mellitus with a range of 1.7 years. The majority of the participants in this study had (55.5 %) comorbidity with the most common disease being hypertension (28.0 %). In terms of diabetes comorbidity, most of the Indonesian prevalent of comorbidity were hypertension which was accelerated to microvascular disease (Soewondo, Ferrario & Tahapary, 2013). Type 2 diabetes mellitus occurs when the insulin receptors of the cell were insensitive to the insulin present in the blood (American Diabetes Association, 2015). The causes of diabetes mellitus and hypertension come from an unhealthy behavior such as lack of exercise, consuming unhealthy food, and uncontrol with diabetes mellitus (Hoehn et al., 2009).

This study result of comorbidity was similar to the previous study of Primanda, Kritpracha & Thaniwattananon, (2011) with 54.3 % of participants having comorbidity and the most common disease was hypertension (13.2 %) . In this study more than half (82,3%) consumed Biguanides diabetes medication and most of the participants (65.2 %) used single dosage medicine. In this study for fasting blood glucose with an average FBG of 144 mg/dl (*SD*= 55.7, min-max 70-450) mg/dl) most of the participants (75.0 %) had FBG level ≤154 mg/dl which mean most of the participants in this study achieving a glycemic control (American Diabetes Association, 2015) and RBS with an average of 190 mg/dl (SD 79.8, min-max 89-435 mg/dl), more than half of the participants (59.4%) <200 mg/dl which mean more than

half of the participants had met the diabetes mellitus target control (HbA1c < 7% = 154mg/dl) (American Diabetes Association, 2015).

Level of Perceived Benefits, Perceived Barriers, and Treatment Adherence

The first objective was to identify the level of perceived benefits, perceived barriers, and treatment adherence. Overall, the levels of perceived benefits were at a high level (*M*ean = 3.23, *SD* = .66). The reason that explained the level of perceived benefits was at a high level was because the 4 sub-dimensions consisting of medication adherence, dietary behavior, physical activity, and regular self-monitoring blood glucose were at a high level (Table 3).

Most of the older adults in this study had a high level of perceived benefits of medication adherence because they believed that medication could prevent any diabetes complications, and control blood glucose levels. This finding was similar to the previous study from Lau, Briesacher, Mercaldo, Halpern, Osterberg, Jarzebowski, and Mazor, (2008) found that the participants in this explained that medication was considered more important because of their indications such as treating the heart condition and participants also assigned that whenever they skipped medication poor test results will occur.

A majority of the older adults had a high level of perceived benefits of dietary behavior. They believed by following a good diet regularly this could prevent diabetes complications from developing and keep blood sugar levels down. This finding was similar to the earlier study from Pawlak, and Colby, (2009) most of the participants indicated that diseases such as heart disease could be prevented by eating more fruits, vegetables, whole grains, and could leave longer, losing weight and being healthier.

More than half of the older adults had a high level of perceived benefits of physical activity. They believed that physical activity prevents complications of diabetes from developing and they would live longer if they exercise regularly. This finding was similar to the earlier study from Zunft et al., (1999) most of the participants indicated physical activity prevention and therapy of cardiovascular disease.

Most of the older adults had a moderate level to high level of perceived benefits of regular self-monitoring. They understood how to operate the blood glucose meter instrument, and they were concerned about their blood sugar levels which could lead to complications of diabetes mellitus. This finding was similar to the earlier study from Chlebowy, Hood and Lajoie (2010) that most of the participants indicated that self-monitoring functions to the reflection of self-awareness to the disease and most of the participants reported their health conditions.

Another reason why perceived benefits were high level because most of the participants (70.2 %) in this study lived with their family members. The families were supportive because they always reminded them to consume medication, cooked healthy food according to the instructions of the health care providers, exercised together and they had accompanied them to check the blood sugar level at the health care center or hospital. Family relationships can be an important source of support of people with diabetes (Albright, Parachman & Burge, 2011). Patients with supportive families are likely to have healthier behavior outcomes (Barcia-Huidbro, Bittner, Barhm & Puschle, 2011).

Overall, the level of perceived barriers was at a low level (*Mean* = 1.81, *SD* = .73). The reason perceived barriers were at a low level because all of the sub-

dimensions consisting of medication adherence, dietary behavior, physical activity, and regular self-monitoring blood glucose were at a low level (Table 3).

A majority of the older adults had a low level of perceived barriers to medication adherence because they were convinced that it was important to consume diabetes medication, they always bring their medication everywhere they go and medication were inexpensive for them. The reason why the medication was inexpensive for them because most of the participants (73.2 %) had enough income/Month and the family sometimes bought medication for them. According to the culture of Indonesia, family support is high, most of the older adults in Indonesia lived with their married child because they had a high care to older adults and the children always watch them doing their activities and support all of their needs. The Children will ask their parents if they need any money (Ni Made, Junaiti, & Yeti, 2013).

Most of the older adults had a low level of perceived barriers to dietary behavior even though they were eating around people who were eating foods that they should not eat they were not influenced to eat, and the recommended food was not expensive. In this study majority of the participants (91.5%) attended the diabetes education in the health care and the family member also accompany them. The health care also gave education to the family so family able to cook the food according to the recommendation from the health care and to always remind them to control their appetite where ever they go. A study from Ali and Rizvi, (2009) mentioned that a nutrition education improves the intake and behaviors related to whole grain foods in meal recipients and was more knowledgeable about correct ways to identify whole

grain foods and reported an increased intake of whole grain bread, cereal, and crackers.

A majority of the older adults had a low level of perceived barriers to physical activity exercise regularly even though the place was far from their house. In this study the health care providers were every active to the participants, they always remind the participants to do exercise even though there were obstacles and on every Tuesdays and Thursdays the health care center has a schedule to do exercise together with the health care and participants. Health care providers had an important role in good behavior outcomes and achieving a good glycemic control of type 2 diabetes mellitus through exercise (Aubert et al., 2012).

Most of the older adults had a low level of perceived barriers to regular self-monitoring because they were convinced that it was important to check blood glucose. The reason older adults were convinced in this study was that the health care providers explains clearly to the participants every time they attended the diabetes education how important to check blood sugar.

Another reason perceived barriers were at a low level where most of the participants (91.2 %) in the study attended diabetes education at the health care center. Most of the patients who received diabetes education will gain knowledge how to control their blood sugar, and prevent complications (Petek, Rotar-Pavlic, Kersnik & Svab, 2010) and most of the participants (75.5 %) who checked for FBS in this study achieving glycemic control ≤ 154 mg/dl and more than half of the participants (59.4 %) who checked for RBS had a good glycemic control < 200 mg/dl.

Overall, the level of treatment adherence was at a moderate level (*Mean* = 2.83, *SD* = .83). The findings indicated that the reason treatment adherence was at a

moderate level was because all of the sub-dimensions were at a moderate level and high level. This means that the participants moderately adhere to treatment adherence (Brooks, 2002).

A majority of the older adults' treatment adherence to medication adherence was at a moderate level because most of the participants consumed medication on time every day, and they always picked up their new medication at the hospital whenever their medication ran out and still consume medication even though they feel well. Older adults in this study with medication adherence were found adhere to medication because most of the participants in this study had join diabetes education regularly by the health care. Most of the participants (91.5 %) received diabetes education helped them to adapt to better behavior in adhering to the treatment of diabetes mellitus and to control their blood sugar (Petek, Rotar-Pavlic, Kersnik & Svab, 2010).

A majority of the older adult's treatment adherence to dietary behavior was at a high level because they follow all instructions from the health care what food they must eat. Most of the participants in this study adhere to the diet of diabetes because of family support who always remind them to always control their diet. Patients with supportive families were more likely to have a healthier behavior (Barcia-Huidbro, Bittner, Brham & Puschel, 2011).

A majority of the older adult's treatment adherence to physical activity was a moderate level because the participants still exercise even though their shoes were wet and they will still exercise even though the location may not be good. The reason why the participants still adhere to physical activity even though there were obstacles because the health care providers also teach how to do exercise at home such as;

diabetes foot exercise, and exercise. This will help the participants to adhere to exercise even though there were obstacles.

A majority of the older adult's treatment adherence to regular self-monitoring was at a low-level level because most of the participants did not check their blood sugar levels every day and had no equipment for check blood sugar at home but they understood that checking blood sugar is important. To have this equipment for blood glucose is expensive, but every time the health care center had a diabetes education the participants who want to join the diabetes education they must check their blood sugar in the health care center.

The cause of treatment adherence was at moderate level because in this study the demographic data showed that most participants (88.4%) have (1-5) family members to help them adhere to the treatment of diabetes mellitus. Another study by Nagelkerk, Reick and Meengs (2006) family relationships played an important role in the behaviors of patients with type 2 diabetes mellitus. On the other hand, the participants in this study had positive support from their family, and every time the patients had a meeting in PERSADIA the family joined with them and also learned from the health care providers.

Relationship Between Perceived Benefits, Perceived Barriers, and Treatment Adherence

The second research question is on the relationship between perceived benefits, perceived barriers and treatment adherence. There is a significant positive correlation between perceived benefits and treatment adherence (r = .690, p = 0.000). This can be explained that the perceptions among older adults with type 2 diabetes

mellitus in this study had a positive consequence of adopting a health behavior that can improve the consequently of treatment adherence (Pender, 2011). Which means when perceived benefit to action is high and the willingness was high, the expected behavior takes place then the participants would significantly adhere to the treatment (Pender, Carolyn & Mary, 2014). An individual's expectation to engage in a particular behavior depends on the anticipated benefits. Perceived benefits are proposed to, directly and indirectly, motivate behavior through determining the extent of a commitment plan of action to engage in the behaviors (Glanz, Rimer & Viswanath, 2008).

Perceived benefits increase the degree of treatment adherence of diabetes mellitus. This finding was consistent with the previous study by Pourghazneina, Ghaffarib Hasanzadeh, and Chamanzari, (2013), perceived benefits with patients type 2 diabetes mellitus was found a significant positive relationship between perceived benefits and treatment adherence. This study also has been supported that the majority of type 2 diabetes mellitus cases agreed that perceived benefits adhered to treatment recommendations (medication, diet, and exercise) and they believed that taking their prescribed treatment plans would help them to stay well (Pourghazneina, Ghaffarib Hasanzadeh & Chamanzari, 2013).

In this study, the participants (91.5%) received knowledge regarding the PERSADIA health center group routinely every once a month. Twice a week on Tuesday and Thursday nurses in PERSADIA exercise together with the older adults as well checked the older adults for blood pressure, and blood glucose levels. The health care providers also evaluated whether the patients understood how to treat for high blood sugar levels and also taught them that even though they may experience

difficulties they must consume medication on time, eat healthy food, exercise regularly, and monitor blood sugar.

The health care providers encourage the participants they that they must adhere to the treatment of diabetes to maintain their blood sugar. The result from this study about the blood sugar level of the participants were most of the participants (75.5 %) who checked for FBS in this study achieving glycemic control ≤ 154 mg/dl and more than half of the participants (59.4 %) who checked for RBS had a good glycemic control < 200 mg/dl (American Diabetes Association, 2015).

In PERSADIA Bandar Lampung, West Sumatera, Indonesia, the health care providers build a good relationship by exercising together with patients twice a week on Tuesdays and Thursdays. Every month the health care providers give a presentation of a clear understanding to the patients how to prevent from complications of diabetes. So this could influence the older adults with type 2 diabetes mellitus in PERSADIA to really cooperate well with the health care providers. A good relationship and good communication between the health care providers and the patients is very important for patients to adhere to the treatment of diabetes mellitus (Aubert et al., 2002).

There is a significant negative relationship between perceived barriers and treatment adherence (r = -.453 p = 0.000). This can be explained that the perceptions among older adults with type 2 diabetes mellitus in this study had negative consequences in adopting a health behavior that positively reinforced the behavior and consequently treatment adherence (Pender, 2011). Which means in regards to the perception of the participants of the barriers, they would significantly adhere less to the treatment because when the barriers are low and the willingness is high, the

expected behavior is likely to take place (Pender, Carolyn & Mary, 2014). This finding was consistent with the previous study by Pourghazneina, Ghaffarib, and Chamanzari, (2013) found that there was a significant negative relationship between perceived barriers and treatment adherence with type 2 diabetes mellitus.

In this study, the researcher only focused on the perceived benefit and perceived barrier of PHPM. According to PHPM, there are other factors that affect behavior outcomes such as perceived self-efficacy, activity-related affect, interpersonal influence, and situational influence. Therefore it is also important to search the level of those factors and relation between those factors and treatment adherence.

Chapter 5

Conclusion and Recommendations

This was a descriptive correlational study. One hundred and sixty-four participants with diabetes mellitus from PERSADIA Bandar Lampung, West Sumatera, Indonesia who met the inclusion criteria were recruited for this study. The goal of this study was to identify the level of perceived benefits, perceived barriers, and treatment adherence and the relationship between perceived benefits, perceived barriers, and treatment adherence among Indonesian older adults with type 2 diabetes mellitus.

Each participant was asked to fill in the demographic and health information form (DHIF) questionnaire, and the perceived benefits, perceived barriers, and treatment adherence questionnaire. The instruments were validated by 3 experts in diabetes care. Reliability was performed for the Indonesian version of the perceived benefits, perceived barriers, and treatment adherence questionnaire and was tested with 30 participants with diabetes mellitus who met the inclusion criteria. Cronbach's alpha revealed a reliability score for perceived benefits of 0.92, perceived barriers 0.81, and treatment adherence 0.82.

Descriptive statistics were used to analyze and describe the data in this study. The descriptive statistical analysis which included means, standard deviation, and percentage were used to describe the demographic and medical characteristics. Pearsons' correlation was used to examine the relationship between perceived benefits, perceived barriers, and treatment adherence.

This study found overall that the level of perceived benefits was at a high level (*Mean* = 3.23, SD = .66). Overall, the level of perceived barriers was at a low level (*Mean* = 1.81, *SD* = .39). Overall, the level of treatment adherence was at a moderate level (*Mean* = 2.83, *SD* = .80). In addition, there was a significant positive correlation between perceived benefits and treatment adherence (r = .690, p <0.001). In contrast, the study found a significant negative relationship between perceived barriers and treatment adherence (r = - .453, p < 0.001).

Strengths and Limitations

The strength in this study most of the participants have joined diabetes education in PERSADIA and the target population in this study are well organized by PERSADIA Bandar Lampung, West Sumatera, Indonesia Health Care.

Despite the strengths, there are limitations in the sub-scale of physical activity questions which the researcher modified from Sechirst, Walker & Pender (1987) and Brooks (2002). All of the questions ask only about exercise. However, the physical activity covered all activities such as cleaning the house and taking care of a grandchild. This may affect the low level of physical activity in treatment adherence.

Implications and Recommendations

The research findings clearly support that overall mean of perceived benefits is at a high level, perceived barriers is at a low level, treatment adherence a moderate level and there is a significant positive correlation between perceived benefits and treatment adherence. In addition, there is a significant negative relationship between perceived barriers and treatment adherence. There are several recommendations for nursing practice, nursing education, and future research study.

Nursing Practice

The findings of the study were relevant in nursing practices which are described below:

1. This study provides information regarding how older adults perceived treatment adherence. The nurses can design interventions on giving education to participants and family to enhance treatment adherence among older adults with type 2 diabetes mellitus.

2. The nurses should understand the older adults difficulties in maintaining treatment adherence to control their blood sugar level. They can find a strategy to help the older adults increase the treatment adherence.

3. Regarding the treatment adherence of regular self-monitoring blood glucose was showed lower than other dimensions. Nurses should focus on the ways to help the older adults to check their blood sugar even though they do not have the equipment, for example, teaching the patients to observe the sign and symptoms of hypoglycemia and hyperglycemia.

Nursing Education

1. The findings from this study can increase the ability of nurse educators to teach students or their staff to provide education to the patients to increase their perceptions toward treatment adherence.

2. This study had found that has several parts of perceived barriers are quite high, for example, how to use and interpret blood sugar levels. It is the nurse's duty to educate the patients on how to use and interpret blood sugar levels.

Further Research Study

1. This study has positive findings, and further research should be conducted. In this study the researcher used only two factors which are perceived benefits, and perceived barriers from behavior-specific cognitions and affect from Pender's theory, therefore, it would be better to include two other factors such as perceived self-efficacy and activity related effect related to treatment adherence.

2. In addition, the intervention study can be developed to increase perceived benefits and to reduce perceived barriers toward treatment adherence, so the participants are able to continually adhere to the treatment of diabetes.

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APPENDICES

APPENDIX A

INFORMED CONSENT FORM

Research Information Sheet

Dear Participant,

My name is Mr. Dwight Mahaputera Marulitua Hutapea, and I am a master student, Faculty of Nursing Prince of Songkla University, Hatyai, Thailand. I am conducting a research entitled Perceived Benefit, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus. This study has been approved by the Research Ethics Committee of Prince of Songkla University, Thailand as well as having granted permission granted by PERSADIA Bandar Lampung, Indonesia. This study will contribute to improving the quality of health care. I am inviting you to participate in my research study.

For this, the researcher would like to ask you to participate in this study. You just need to fill in several questionnaires of perceived benefit of treatment adherence, perceived barriers of treatment adherence and treatment adherence with type 2 diabetes mellitus. This process will take around 15-40 minutes.

Risk and Comfort

There are no known risks or any harm to you to join in this research. There is no payment for you to participate in this research.

Benefit

This study will be a benefit to the participants in order to clarify your understanding of your perceptions to treatment adherence whether it is a benefit or

barriers to your health. This study can be used as a protocol for nurse and other health care professionals to provide treatment adherence in patients with type 2 diabetes mellitus. The data from this research will be used to write a research paper. It will also provide useful information for future research related to this area.

Confidentiality

All information and the participant's responses will be kept strictly confidential. Only the researcher and researcher assistant are eligible to access the data. Neither your name nor identifying personal information will be used in the report of this research.

Participation and Withdrawl from Participation

The participation in this research is voluntary. Signing the informed consent form states your willingness to participate. During any time of this study, you have the right to withdraw with no influence to your medical service or medical treatment.

If you have any question, suggestion, or cannot participate in this study, you directly contact the researcher at mobile phone (+66986835910). Finally, if you agree to participate in this study, please kindly sign in your name on the consent form or verbally state your agreement to participate in the study.

Thank you for your cooperation

(Dwight Hutapea)

Researcher

The researcher will give thanks for the willingness to join this study. Any kind of question and any further information regarding this research will be asked to the researcher in the following address.

Dwight Hutapea (Email: dwighthutapea@gmail.com, Hp: +66986835910)

Master of Nursing Science (International program)

Prince of Songkla University, Hatyai, Thailand

Name of the participant	Signature of the participant	Date
Name of the researcher	Signature of the researcher	Date

INFORMED CONSENT FORM

Study title: Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus

Researcher: Dwight Mahaputera Marulitua Hutapea (Master Student, Faculty of Nursing, Prince of Songkla University, Hatyai, Thailand)

Patient's Name: _____ Age: _____

Patient's Concent

I, _____, was performed of the details of the research entitled as above and was ensured that all of the information related to personal information, health history, and research design will be kept confidential. If any problem or issue arise. I can discuss with the researcher. I have the right to withdraw from the study at any time without any effect to my medical devices and medical treatment. I am willing to participate in this research study voluntarily, without any threat and force. Hereby, I endorse my signature.

Given by: _____ (Consenter) Date: _____

Researcher's note

I had given the detailed information of the research article entitled as above to the patient. The signature and returning the form indicate that you understand what is involved and that you consent the participate in this study voluntarily. You have been given the opportunity to ask question and were satisfied with the answer

Signature :_____ (Researcher) Date:_____

Code : ……

Date : …….

APPENDIX B

Questionnaires

"Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Older Indonesian Adults with Type 2 Diabetes Mellitus"

Dwight Mahaputera Marulitua Hutapea
Faculty of Nursing, Prince of Songkla University, Hatyai, Thailand

Demographic and Health Information Form

Instruction: Give ( ) to your condition right now in the columns below:

1. Age:…….years
2. Gender: ( ) Pria ( ) Wanita
3. Religion: ( ) Hindu ( ) Muslim ( ) Christian ( ) Buddha ( ) Katolik
4. Level of Education: ( ) Non-formal education ( ) Elementary school ( ) Junior high school
   ( ) Senior high school ( ) Bachelor/higher
5. Marital Status: ( ) Single ( ) Married ( ) divorce
6. Job last held: ( ) Private ( ) Government ( ) Retired
7. Income/month: Rp……..
8. Income Sufficiency: ( ) Enough ( ) Not enough
9. Accessible health service: ( ) Health care center ( ) Hospital
10. Age at onset of the disease: …….years
11. Duration of diabetes mellitus: …….years
12. Name of medicine used: ……..…….
13. Dosage of the medicine : ……tablet/hari
14. Number of family member:living with you: ……..persons
15. Family history of diabetes mellitus: ( ) Grandfather ( ) Grandmother ( ) Aunt ( ) Uncle ( ) Father ( ) Mother

16. Person responsible for cooking at home: ( ) Self ( ) Son ( ) Daughter ( ) Wife ( ) Maid
17. Experience in receiving diabetes education through seminar or consultation session by health care provider: ( ) Yes ( ) No
18. Fasting blood glucose: …. …..mg/dL, …… % (HbA1c)
19. Medical Test Report

    …….
20. Surgery underwent in the past 10 years:…..…….
21. Comobility: ( ) High blood pressure ( ) Heart Disease ( ) High blood lipid

Code : ……

Date : ……

APPENDIX C

Questionnaire

Perceived Benefit of Type 2 Diabetes Mellitus Treatment Adherence

Instruction: List below are a number of things that make you more easy to follow the treatment of diabetes mellitus, for each item please indicate how often the situation generally occurs to you, using the scale below. If the particular scale below applies to you please make a mark on the table.

Please give mark "√"

1 = Strongly Disagree. Choose this option if you strongly disagree with the condition because it does not represent your real situation.

2 = Disagree. Choose this option if you disagree with the condition because it does not represent your real situation.

3 = Agree. Choose this option if you agree with the condition because it does not represent your real situation.

4 = Strongly agree. Choose this option if you strongly agree with the condition because it does not represent your real situation.

Medications		1	2	3	4
1	Medications help me to prevent diabetes complications	1	2	3	4
2	My glucose level will decrease after consuming medicine for diabetes	1	2	3	4
3	I believe that the more ontime I consume my medicine for diabetes the faster my blood sugar	1	2	3	4

	will decrease				
4	I believe that medications will control my diabetes	1	2	3	4
5	Medicine for diabetes will ensure that I will live longer	1	2	3	4
Dietary behavior		1	2	3	4
6.	Following diet instruction from health care provider for diabetes mellitus will keep me from having high blood glucose	1	2	3	4
7.	My family members always cook my foods according to the instruction given by the health care provider	1	2	3	4
8.	Diet instructions from the health care provider enable me to make intelligent choices on healthy foods	1	2	3	4
9.	Healthy food can prevent me from developing complications of diabetes in my body	1	2	3	4

Physical Activity		1	2	3	4
10.	Regular exercise decreases my blood sugar level	1	2	3	4
11.	Regular exercise improves my stamina	1	2	3	4
12.	Regular exercise increases my muscle strength	1	2	3	4
13.	I will live longer if I exercise regularly	1	2	3	4
14.	Regular exercise can prevent me from developing	1	2	3	4

	complications of diabetes in my body				
Regular self-monitoring blood glucose		1	2	3	4
15.	I know how to operate my blood glucose meter tool	1	2	3	4
16.	Since blood sugar level is an important factor in diabetes treatment, therefore I am concerned about my blood sugar level	1	2	3	4
17.	My family members always monitor my blood sugar level	1	2	3	4
18.	I believe self-monitoring blood sugar regularly will help me prevent occurrence of diabetes complications in my body	1	2	3	4

Perceived Barriers of Type 2 Diabetes mellitus Treatment Adherence Questionnaire

Code : ……

Date : …….

Instruction: List below are a number of things that make you more easy to follow the treatment of diabetes mellitus, for each item please indicate how often the situation generally occurs to you, using the scale below. If the particular scale below applies to you please make a mark on the table.

Please give mark "√"

1. Strongly Disagree. Choose this option if you strongly disagree with the condition because it does not represent your real situation.
2. Disagree. Choose this option if you disagree with the condition because it does not represent your real situation.
3. Agree. Choose this option if you agree with the condition because it does not represent your real situation.
4. Strongly agree. Choose this option if you strongly agree with the condition because it does not represent your real situation.

Medications		1	2	3	4
1	I do not consume my diabetes medicine regularly because I am not at home when it is time to take this medicine	1	2	3	4
2	I am convinced that it is not important to consume my diabetes medications	1	2	3	4
3	I think I waste a lot of time just to take my diabetes medications	1	2	3	4

4	I think diabetes medication is expensive	1	2	3	4
5	I feel awkward with other people around me when it is time to take my medications	1	2	3	4
Dietary Behavior		1	2	3	4
6.	I am unsure about the right amount of food I need to consume to maintain good blood sugar level	1	2	3	4
7.	I am convinced that it won't matter if I don't follow my diet instructions from the health care providers	1	2	3	4
8.	I am around other people who are eating or drinking things I shouldn't	1	2	3	4
9.	The cost of the recommended foods to eat according to meal plan is expensive	1	2	3	4
10.	It needs much time to prepare my foods	1	2	3	4

Physical Activity		1	2	3	4
11.	Exercise tires me	1	2	3	4
12.	Exercise is a hard physical work for me	1	2	3	4
13.	My family members do not encourage me to exercise regularly	1	2	3	4
14.	Places for me to exercise are too far away from my house	1	2	3	4
15.	There are few places for me to exercise	1	2	3	4
Regular self-monitoring of blood glucose		1	2	3	4

16.	My family has no time to accompany me to test my blood glucose level in the hospital	1	2	3	4
17.	I don’t have necessary materials or equipment with me to test my glucose level	1	2	3	4
18.	I am convinced that it is not important to check my blood glucose level	1	2	3	4
19.	I feel awkward with other people around me when it is time to take my glucose	1	2	3	4
20.	The cost of materials for testing my blood glucose level is expensive	1	2	3	4

Treatment Adherence Questionnaire

Code : ……

Date : ……

Instruction: List below are a number of things that indicate you diabetes mellitus treatment adherence with for each item please indicate how often the situation generally occurs to you, using the scale below. If the particular scale below applies to you please make a mark on the table.

Please give mark "√"

1. Never. Choose this option if it never happens with your condition
2. Occasionally. Choose this option if it occasionally happens with your condition
3. Sometimes. Choose this option if it sometimes happens with your condition
4. Always. Choose this option if it always happens with your condition

Treatment Adherence Questionnaire	1	2	3	4
Medications	1	2	3	4
1. I consume my type 2 diabetes mellitus medication within the usual time every day	1	2	3	4
2. I take my medications even when I get sick with high fever or when I am nausea and vomiting	1	2	3	4
3. I still consume my diabetes medication even though I fell well	1	2	3	4
4. I refill your medicines before they run out	1	2	3	4
5. Every time my medications run out I buy new medications in the hospital	1	2	3	4
Dietary behavior	1	2	3	4
6. I stay on my diet when I eat out	1	2	3	4
7. I eat according to the diet instruction from the health provider	1	2	3	4
8. I eat foods that I should avoid on my diet	1	2	3	4

9. I follow all instructions from the health care for my diet	1	2	3	4
10. I eat more on those days when I get more exercise than usual	1	2	3	4
Physical activity	1	2	3	4
11. I do exercise every day for 30-60 minutes every day	1	2	3	4
12. Even though the weather is bad I still go for exercise	1	2	3	4
13. Even though the location is not convenient I still go for exercise	1	2	3	4
14. I always say to myself that exercise is important for me	1	2	3	4
15. Even though my shoes are wet I will still go for exercise	1	2	3	4
Regular self-monitoring blood glucose	1	2	3	4
16. I check my blood glucose every day	1	2	3	4
17. I always bring with me the equipment to check my blood glucose everywhere I travel	1	2	3	4
18. I always observe the sign and symptoms of hyperglycemic and hypoglycemic	1	2	3	4
19. I never feel ashamed whenever I check my blood sugar in front of people	1	2	3	4
20. I always inform to the hospital and tell the result of my blood sugar levels	1	2	3	4

Kuesioner Penelitian

"The Relationship between Perceived Benefits, Perceived Barriers, and Treatment Adherence among Older Indonesian Adults with Type 2 Diabetes Mellitus"

Dwight Mahaputera Marulitua Hutapea
Faculty of Nursing, Prince of Songkla University, Hatyai, Thailand

Petunjuk: Beri tanda ( ) pada bagian yang menyatakan penilaian Anda terhadap pernyataan berikut ini:

22. Usia:…….tahun
23. Jenis kelamin: ( ) Pria ( ) Wanita
24. Agama: ( ) Hindu ( ) Islam ( ) Kristen ( ) Buddha ( ) Katolik
25. Tingkat Pendidikan: ( ) Pendidikan non-formal ( ) Sekolah dasar/SD) ( ) Sekolah Menengah Pertama/SMP
    ( ) Sekolah Menengah Atas/SMA ( ) Sarjana/S-1 atau lebih tinggi
26. Status: ( ) Belum pernah menikah ( ) Menikah ( ) Cerai
27. Pekerjaan terakhir: ( ) Swasta ( ) Pegawai Negeri Swasta/PNS ( ) Pensiun
28. Penghasilan per bulan: Rp……..
29. Penghasilan bulanan: ( ) Mencukupi ( ) Tidak mencukupi
30. Pelayanan kesehatan yang mudah dijangkau: ( ) Puskesmas ( ) Rumah sakit
31. Usia saat mulai menderita diabetes: …….tahun
32. Lamanya menderita diabetes: ……tahun.
33. Nama obat diabetes yang dkonsumsi: …….
34. Dosis obat yang dikonsumsi: ……tablet/hari
35. Jumlah anggota keluarga yang tinggal bersama dengan Anda: ……..orang
36. Anggota keluarga yang menderita diabetes: ( ) Kakek ( ) Nenek ( ) Ayah ( ) Ibu ( ) Paman ( ) Bibi
37. Orang yang memasak makanan di rumah Anda: ( ) Sendiri ( ) Isteri/suami ( ) Anak ( ) Pembantu

Pernah mendapatkan penyuluhan tentang diabetes melalui seminar atau konsultasi kesehatan dengan pegawai kesehatan:

( ) Pernah ( ) Tidak pernah

38. Kadar gula darah puasa: …. …..mg/dL, …… % (HbA1c)

39. Hasil pemeriksaan kesehatan…….

40. Tindakan operasi yang pernah dijalani:…….

41. Penyakit lainnya yang juga diderita saat ini: ( ) Tekanan darah tinggi ( ) Penyakit jantung ( ) Tinggi lemak darah/kolesterol

Petunjuk: Lingkari nomor yang ada di depan penilaian Anda terhadap pernyataan berikut ini:

No.	**Pernyataan**	**Pilihan Penilaian**			
1.	Obat diabetes dapat mencegah terjadinya komplikasi diabetes.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
2.	Kadar gula darah saya turun setelah mengkonsumsi obat diabetes.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
3.	Saya percaya bahwa jika makan obat diabetes tepat waktu maka kadar gula darah saya akan lebih cepat turun.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
4.	Saya percaya bahwa obat diabetes yang saya makan dapat menurunkan kadar gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
5.	Obat diabetes saya dapat membantu memperpanjang umur saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju

6.	Menuruti petunjuk tentang pola makan yang baik yang diberikan oleh penyuluh kesehatan maka kadar gula darah saya akan jadi lebih baik.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
7.	Menuruti petunjuk yang diberikan oleh penyuluh kesehatan tentang pola makan yang baik dapat memperbaiki tingkat kesehatan saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
8.	Apa yang diajarkan oleh penyuluh kesehatan membuat saya lebih pandai dalam memilih jenis makanan sehat.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
9.	Makanan sehat dapat mencegah terjadinya komplikasi diabetes dalam tubuh saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
10.	Olaharaga dapat menurunkan kadar gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
11.	Olahraga meningkatkan stamina dan kebugaran fisik saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
12.	Olahraga membuat otot saya lebih kuat.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
13.	Umur saya akan lebih panjang jika saya berolahraga dengan teratur.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
14.	Olahraga dapat mencegah terjadinya komplikasi diabetes dalam tubuh saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
15.	Saya tahu cara menggunakan alat pengukur gula darah.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju

16.	Oleh karena menjaga kadar gula darah adalah faktor penting dalam menanggulangi diabetes, maka saya peduli dan menjaga kadar gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
17.	Anggota keluarga saya selalu memperhatikan kadar gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
18.	Saya percaya bahwa memeriksa kadar gula darah sendiri secara teratur dapat mencegah terjadinya komplikasi diabetes dalam tubuh saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
1.	Saya tidak bisa makan obat diabetes dengan teratur karena ketika tiba waktunya untuk makan obat saya sedang tidak di rumah.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
2.	Saya rasa tidak penting makan obat diabetes adalah tindakan yang tidak penting.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
3.	Terlalu banyak waktu terbuang hanya untuk makan obat.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
4.	Obat diabetes saya cukup mahal.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
5.	Rasanya canggung untuk makan obat diabetes jika dilihat orang lain.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
6.	Saya tidak tahu pasti berapa banyak makanan yang harus saya makan.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju

7.	Saya percaya bahwa tidaklah penting untuk mengikuti petunjuk yang diberikan penyuluh kesehatan tentang jenis makanan yang harus dimakan.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
8.	Orang-orang di sekitar saya memakan makanan dan meminum minuman yang tidak boleh saya konsumsi karena saya sakit diabetes.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
9.	Jenis makanan yang cocok dengan penyakit diabetes saya cukup mahal.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
10.	Proses memasak makanan yang cocok dengan penyakit diabetes saya perlu waktu yang cukup lama.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
11.	Kegiatan olahraga membuat saya merasa capek.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
12.	Olahraga adalah kegiatan yang memberatkan secara fisik.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
13.	Anggota keluarga saya tidak mendorong saya untuk berolahraga.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
14.	Letak tempat olahraga terlalu jauh dari rumah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
15.	Hanya sedikit tempat yang bisa saya gunakan untuk berolahraga.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
16.	Anggota keluarga saya tidak punya waktu untuk mengantar saya ke puskesmas atau rumah sakit untuk memeriksa gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju

17.	Saya tidak punya alat pengukur gula darah.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
18.	Saya rasa bahwa tidak terlalu penting untuk memeriksakan gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
19.	Saya sungkan memeriksa gula darah saya kalau sedang dilihat orang lain.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
20.	Biaya untuk memeriksa gula darah saya cukup mahal.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
1.	Saya makan obat diabetes saya pada waktu yang sama setiap hari.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
2.	Saya tetap memakan obat saya walau sedang kurang enak badan seperti karena demam, mual dan alasan lain.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
3.	Saya berkunjung ke rumah sakit berdasarkan hasil pemeriksaan gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
4.	Saya beli ulang obat diabetes sebelum obat yang ada di rumah saya habis.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
5.	Saya beli obat diabetes saya ketika obat itu sudah habis.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
6.	Saya tetap menjaga pola makan yang benar walau pun ketika sedang makan di luar rumah.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat

		setuju			
7.	Saya mengikuti pola makan yang benar seperti yang diajarkan oleh penyuluh kesehatan.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
8.	Saya tetap memakan jenis makanan yang semestinya harus saya hindari.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
9.	Saya mengikuti semua instruksi yang diberikan oleh penyuluh kesehatan tentang pola makan yang baik untuk saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
10.	Saya memakan lebih banyak ketika saya berolahraga lebih sering dari biasanya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
11.	Saya berolahraga setiap hari selama 30-60 menit per hari.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
12.	Saya tetap berolahraga walau pun cuaca sedang buruk.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
13.	Walau pun lokasi tempat olahraga jauh dari rumah, saya tetap pergi kesana untuk berolahraga.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
14.	Saya selalu yakinkan diri saya bahwa olahraga adalah penting bagi kesehatan saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
15.	Walau pun sepatu saya sedang basah, saya tetap pergi berolahraga.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
16.	Saya memeriksa kadar gula darah saya setiap hari.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat

		setuju			
17.	Saya selalu membawa alat pengukur gula darah ketika sedang bepergian.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
18.	Saya selalu memantau gejala rendah gula darah dan gejala tinggi gula darah yang saya alami.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
19.	Saya tidak pernah malu untuk memeriksa gula darah saya walau pun ketika orang lain sedang melihatnya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju
20.	Saya selalu kabari puskesmas atau rumah sakit tentang hasil pemeriksaan gula darah saya.	1. Sangat tidak setuju	2. Kurang setuju	3. Setuju	4. Sangat setuju

APPENDIX C

List of Experts

Three experts validated the content of the validity of the perceived benefits, perceived barriers, and treatment adherence questionnaire, they were:

1. Dr. Charuwan Kritpracha

   Lecturer of Faculty of Nursing Prince of Songkla University Hatyai, Thailand

2. Dr. Reuben Supit

   Physician & Chairperson, Indonesian Diabetes Association, Bandar Lampung Chapter

3. Dr. Maju. S. Simanjuntak

   Diabetes Educator, Faculty of Nursing, Universitas Advent Indonesia

APPENDIX D

Letters of Ethical Consideration and Permission

Letter from PERSADIA Bandar Lampung

DIABETES
INDONESIA
CABANG
BANDAR LAMPUNG

PERSADIA

THE INDONESIAN
DIABETES ASSOCIATION

President
dr. Ronald I. Lisal

Vice President
Elon Manawan, SKp
dr. Yunny Syah, SpPD

Secretary
Helda J. Mailoa, SST-Gizi.,MM

Ass. Secretary
Sinsigus.Amd.KL

Treasurer
Romauli Simbolon ,SE

Human
S. Manawan, S.Kep
Melvin Cornelius, SE
Hodner Gultom, S.Kep

PERSATUAN DIABETES INDONESIA
CABANG BANDAR LAMPUNG

SECRETARIAT

No. 001/Persadia-CBL/I/2016

Assistant Professor Dr. Waraporn Konsuwan
Assistant Dean for Research and Graduate Studies
Faculty of Nursing
Price of Songkla University
Hat Yai, Songkla
THAILAND

Dear Sir/Madam,

We are grateful for application letter conducting research study on behalf Mr. Dwight Hutapea, a Master student of the Faculty of Nursing Prince of Songkla University, Thailand, with the research project entitled: Perceived Benefits, Perceived Barriers and Treatment Adherence among Indonesian Older Adulth with Type 2 Diabetes Mellitus.

We also approved the research was conducted in PERSADIA Rumah Sakit Umum Daerah Pringsewu Lampung and PERSADIA Rumah Sakit Advent Bandar Lampung, Indonesia, in January 2016.

If you need any further information regarding this research study, kindly do not hesitate to contact us at email address : mailoahelda@gmail.com

Sincerely Yours,

Dr. Ronald Lisal
President of Persadia

PERSADIA
CABANG BANDAR LAMPUNG

FACULTY OF NURSING

PRINCE OF SONGKLA UNIVERSITY

P.O. BOX 9, KHOR HONG, HATYAI
SONGKHLA, THAILAND, 90112
FAX NO. 66-74-286421
TEL. NO. 66-74-286456,
66-74-286459

MOE 052101.05/ 3581

December 25, 2015

Head of Health Department,
PERSADIA, Bandar Lampung, West Sumatera Indonesia

Dear Sir/Madam,

This letter is to inform you that Mr. Dwight Hutapea a master student of the Faculty of Nursing, Prince of Songkla University, Thailand, is currently conducting research study. The research project entitled: Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus, is under the supervision of Assist. Prof. Dr. Ploenpit Thaniwattananon. He will conduct the study with type 2 diabetes mellitus at PERSADIA Bandar Lampung, West Sumatera, Indonesia, in January 2016.

I will greatly appreciate if Mr. Dwight Hutapea is permitted to do data collection related with his research topic, as it will provide valuable information for this research study that will contribute to adult nursing care.

If you need any further information regarding his study, please do not hesitate to contact us at the above address or e-mail Assist. Prof. Dr. Ploenpit Thaniwattananon his advisor at: pleonpit.t@psu.ac.th

Sincerely Yours,

Waraporn

(Assistant Professor Dr.Waraporn Konsuwan)
Assistant Dean for Research and Graduate Studies
Faculty of Nursing
Prince of Songkla University
Hat Yai, Songkhla
THAILAND

CC: Head of Public Health Care at PERSADIA, Bandar Lampung

FACULTY OF NURSING

PRINCE OF SONGKLA UNIVERSITY

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SONGKHLA, THAILAND, 90112
FAX NO. 66-74-286421
TEL. NO. 66-74-286456,
66-74-286459

MOE 0521.1.05/3582

December 25, 2015

Dear Dr. Reuben Supit

Mr. Dwight Hutapea ID.5710420007, a master student of the Faculty of Nursing, Prince of Songkla University, Thailand, is conducting his thesis entitled: "Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus". In order to maintain quality of the thesis, the instrument must be validated by experts before data collection.

Since you are one of the experts in this area, I would like to request you as an expert in validating instruments of the above study.

It would be highly appreciated if you could accept to be an expert. Thank you very much for your assistance.

If you need any further information regarding his study, please do not hesitate to contact us at the above address or e-mail Assist. Prof. Dr. Ploenpit Thaniwattananon his advisor at: pleonpit.t@psu.ac.th.

Sincerely Yours,

Waraporn

(Assistant Professor Dr.Waraporn Konsuwan)
Assistant Dean for Research and Graduate Studies
Faculty of Nursing
Prince of Songkla University
Hat Yai, Songkhla
THAILAND

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TEL. NO. 66-74-286456,
66-74-286459

MOE 0521.1.05/ 3583

December 25 , 2015

Dear Dr.Maju. S. Simanjuntak

Mr. Dwight Hutapea ID.5710420007, a master student of the Faculty of Nursing, Prince of Songkla University, Thailand, is conducting his thesis entitled: "Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type 2 Diabetes Mellitus". In order to maintain quality of the thesis, the instrument must be validated by experts before data collection.

Since you are one of the experts in this area, I would like to request you as an expert in validating instruments of the above study.

It would be highly appreciated if you could accept to be an expert. Thank you very much for your assistance.

If you need any further information regarding his study, please do not hesitate to contact us at the above address or e-mail Assist. Prof. Dr. Ploenpit Thaniwattananon his advisor at: pleonpit.t@psu.ac.th.

Sincerely Yours,

Waraporn

(Assistant Professor Dr.Waraporn Konsuwan)
Assistant Dean for Research and Graduate Studies
Faculty of Nursing
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66-74-286459

MOE 0521.1.05/ 3584

Ethics Committee Approval

December 25, 2015

To whom it may concern:

This letter is to confirm that the Nursing Faculty Ethics Committee approved the research study of Mr. Dwight Mahaputera Marulitua Hutapea ID. 5710420007 entitled "Perceived Benefits, Perceived Barriers, and Treatment Adherence among Indonesia Indonesian Older Adults with Type 2 Diabetes Mellitus" under supervision of Assist. Prof. Dr. Ploenpit Thaniwattananon on December 15, 2015. The study is a major part of Mr. Dwight Mahaputera Marulitua Hutapea' s Master Degree at the Faculty of Nursing, Prince of Songkla University, Thailand. The study ensures the rights, safety, confidentiality, and welfare of research participants and it was determined that the study would not be harmful to the participants in the future.

Sincerely,

Waraporn

(Assistant Professor Dr. Waraporn Kongsuwan)
Assistant Dean for Research and Graduate Studies
Faculty of Nursing,
Prince of Songkla University
THAILAND

บันทึกข้อความ

ส่วนราชการ กลุ่มงานวิจัยและบัณฑิตศึกษา คณะพยาบาลศาสตร์ โทร. ๖๔๕๖
ที่ มอ ๖๐๖.๒/ ๑๐๑๖ วันที่ ๒๔ ธันวาคม ๒๕๕๘
เรื่อง ขอความอนุเคราะห์ผู้ทรงคุณวุฒิตรวจสอบเครื่องมือวิจัย

เรียน หัวหน้าภาควิชาการพยาบาลอายุรศาสตร์

ด้วย Mr.Dwight Mahaputera รหัสนักศึกษา ๕๗๑๐๔๒๐๐๐๗ นักศึกษาหลักสูตรพยาบาลศาสตรมหาบัณฑิต (นานาชาติ) คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ กำลังดำเนินการทำวิทยานิพนธ์เรื่อง "Perceived Benefits, Perceived Barriers, and Treatment Adherence Among Indonesian Older Adults with Type ๒ Diabetes Mellitus" โดยมีผู้ช่วยศาสตราจารย์ ดร.เพลินพิศ ฐานิวัฒนานนท์ เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์ ซึ่งในกระบวนการสร้างเครื่องมือวิจัยในเรื่องนี้จำเป็นต้องมีการตรวจสอบความตรงและความเหมาะสมของเครื่องมือวิจัยตลอดจนแนวคำถามต่างๆ เพื่อให้มีความเหมาะสมและครอบคลุมครบถ้วนในประเด็นที่ศึกษา

คณะพยาบาลศาสตร์ จึงใคร่ขอความอนุเคราะห์จากบุคลากรในหน่วยงานของท่าน คือ ดร.จารุวรรณ กฤตย์ประชา ในการเป็นผู้ทรงคุณวุฒิในการตรวจสอบเครื่องมือวิจัยดังกล่าว ทั้งนี้หากต้องการรายละเอียดเพิ่มเติม โปรดติดต่อ Mr.Dwight Mahaputera ที่ E-mail: dwighthutapea@gmail.com

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ด้วย จะเป็นพระคุณยิ่ง

(ผู้ช่วยศาสตราจารย์ ดร.วราภรณ์ คงสุวรรณ)
ผู้ช่วยคณบดีฝ่ายวิจัยและบัณฑิตศึกษา

สำเนาเรียน ดร.จารุวรรณ กฤตย์ประชา Dr. Charuwan Kritpracha

APPENDIX E

Reliability

A pilot study is a small version for conducted before the major study to see the possibility of the study (Polit & Beck, 2012). The purpose researcher conducted a pilot study in order to examine the feasibility of the instruments used. The researcher recruited ten patients who met the inclusion criteria of the present study those patients involved in reliability testing to receive the questionnaire.

From the pilot study, the ten patients had the same times for finishing the questions from the questionnaire. The actions of the researcher and the patient have been observed in the first week during the pilot study. All actions of the researcher were appropriate and understood by the patients. All of the patients also could follow all of the instructions given by the researcher. Based on this pilot study, the researcher did not change any components from the questionnaire because the Cronbach's alpha perceived benefits 0.924, perceived barriers 0.814, and treatment adherence 0.822

Reliability Data Results

Reliability Statistics Perceived Benefits

Cronbach's Alpha	N of Items
0.924	18

Reliability Statistics Perceived Barriers

Cronbach's Alpha	N of Items
0.814	20

Reliability Statistics Treatment adherence

Cronbach's Alpha	N of Items
0.822	20

APPENDIX F
Test Assumption (Normality)

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total_Benefit	164	100.0%	0	0.0%	164	100.0%
Total_Barriers	164	100.0%	0	0.0%	164	100.0%
Total_Treatmen_Adherence	164	100.0%	0	0.0%	164	100.0%

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total_Benefit	.113	164	.000	.944	164	.000
Total_Barriers	.109	164	.000	.966	164	.001
Total_Treatmen_Adherence	.103	164	.000	.971	164	.002

a. Lilliefors Significance Correction

Descriptives

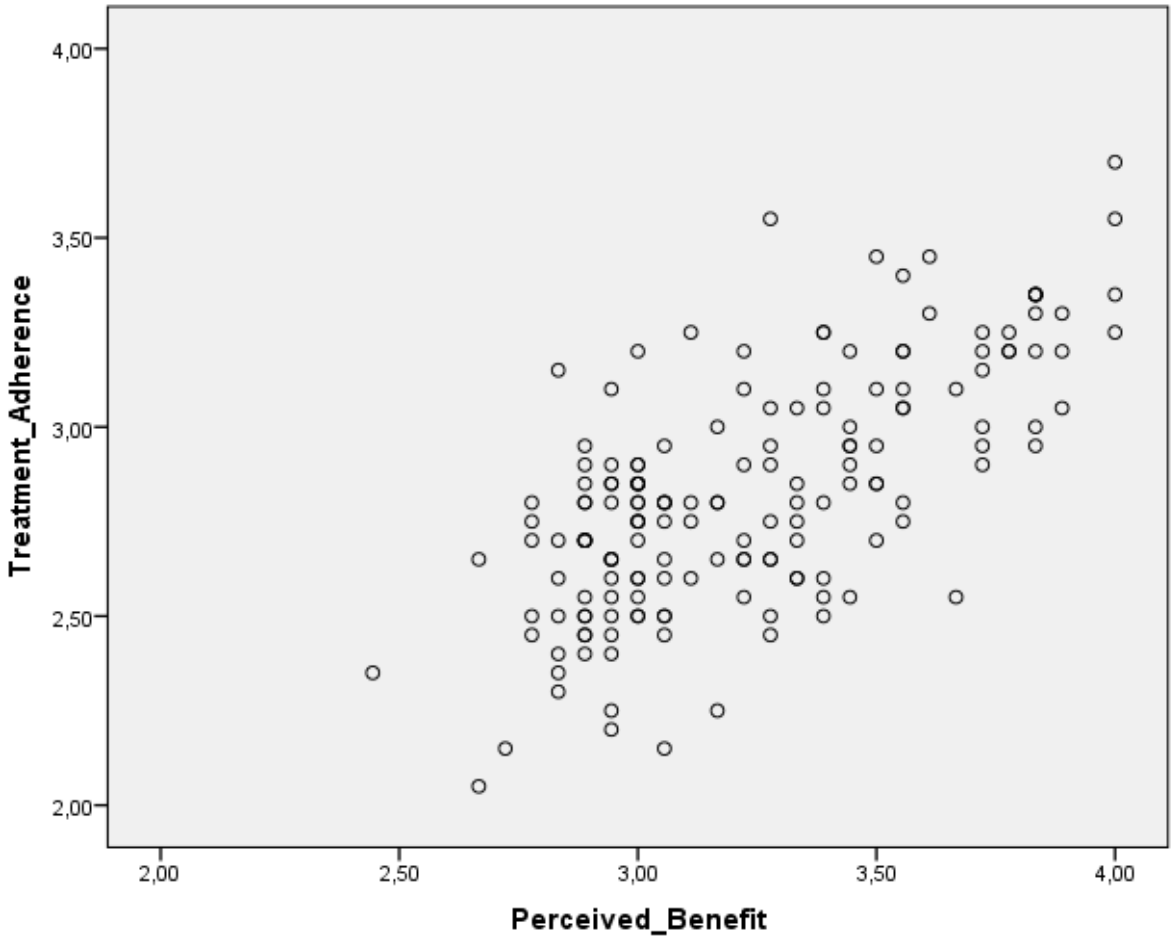
			Statistic	Std. Error	
Perceived_Benefit	Mean		3,2331	,02700	
	95% Confidence Interval for Mean	Lower Bound	3,1798		
		Upper Bound	3,2864		
	5% Trimmed Mean		3,2235		
	Median		3,1667		
	Variance		,120		
	Std. Deviation		,34571		
	Minimum		2,44		
	Maximum		4,00		
	Range		1,56		
	Interquartile Range		,56		
	Skewness		,473	,190	2.47
	Kurtosis		-,709	,377	-1.89

Perceived_Barriers	Mean		1,8070	,03156	
	95% Confidence Interval for Mean	Lower Bound	1,7447		
		Upper Bound	1,8693		
	5% Trimmed Mean		1,8022		
	Median		1,8750		
	Variance		,163		
	Std. Deviation		,40419		
	Minimum		1,00		
	Maximum		3,25		
	Range		2,25		
	Interquartile Range		,55		
	Skewness		-,010	,190	-.5
	Kurtosis		,157	,377	0.20
Treatment_Adherence	Mean		2,8265	,02453	
	95% Confidence Interval for Mean	Lower Bound	2,7781		
		Upper Bound	2,8750		
	5% Trimmed Mean		2,8246		
	Median		2,8000		
	Variance		,099		
	Std. Deviation		,31416		
	Minimum		2,05		
	Maximum		3,70		
	Range		1,65		
	Interquartile Range		,45		
	Skewness		,212	,190	1.10
	Kurtosis		-,253	,377	-0.67

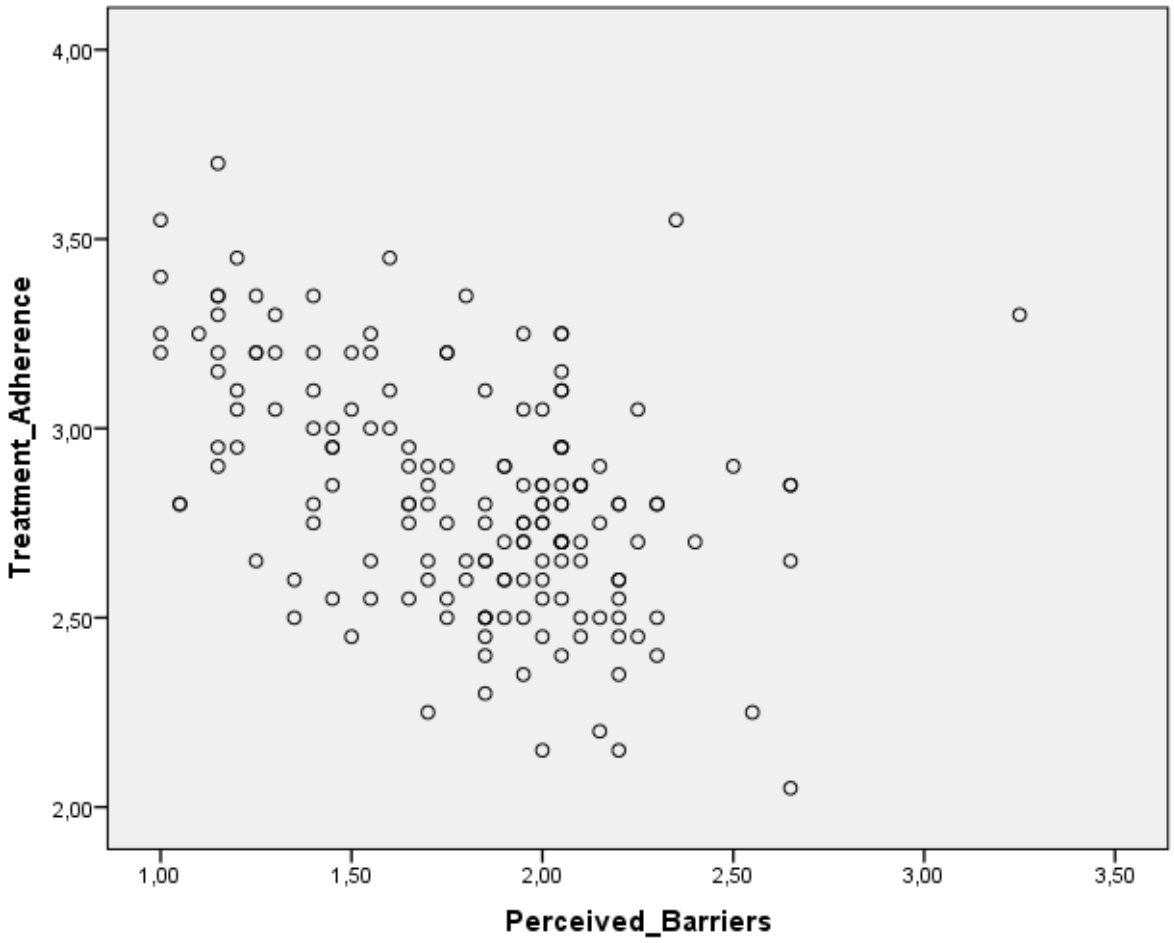
Assumption Linearity

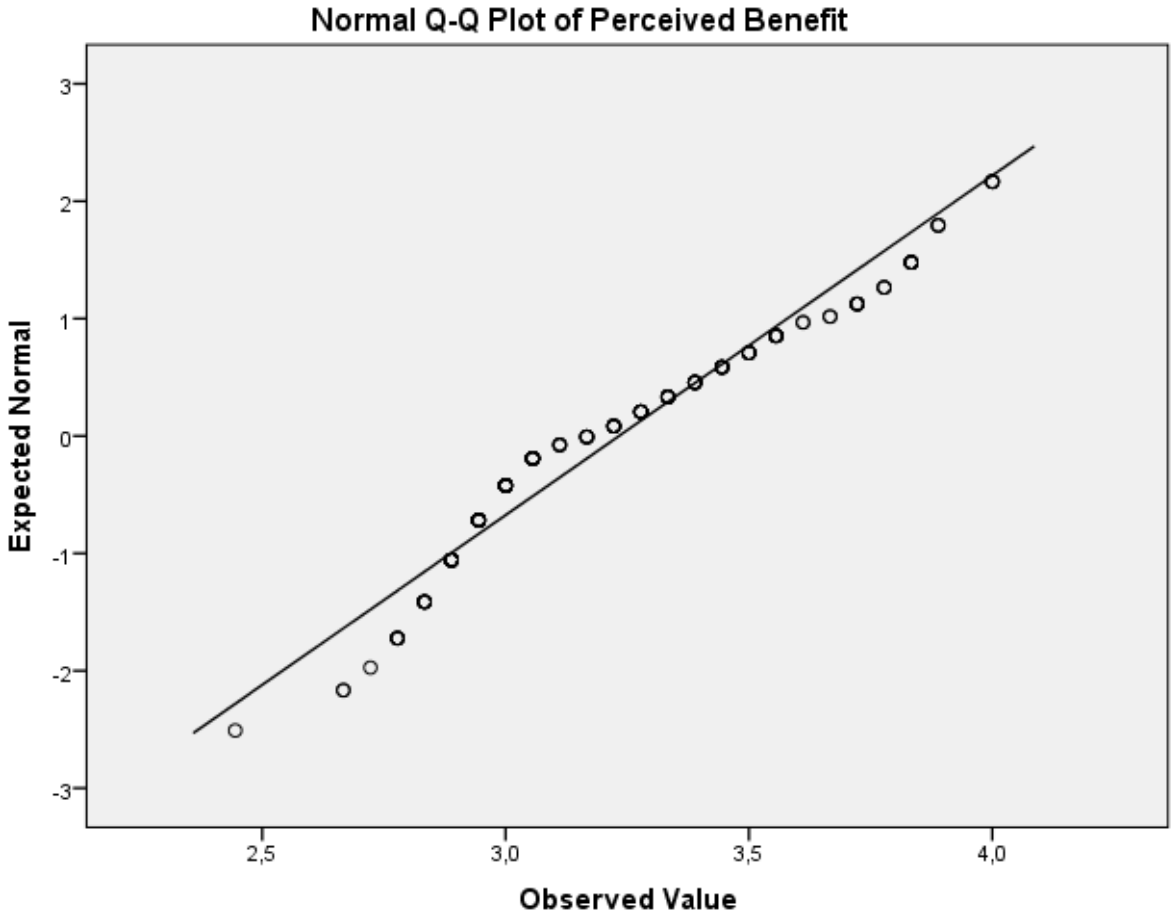
Scatter Plot

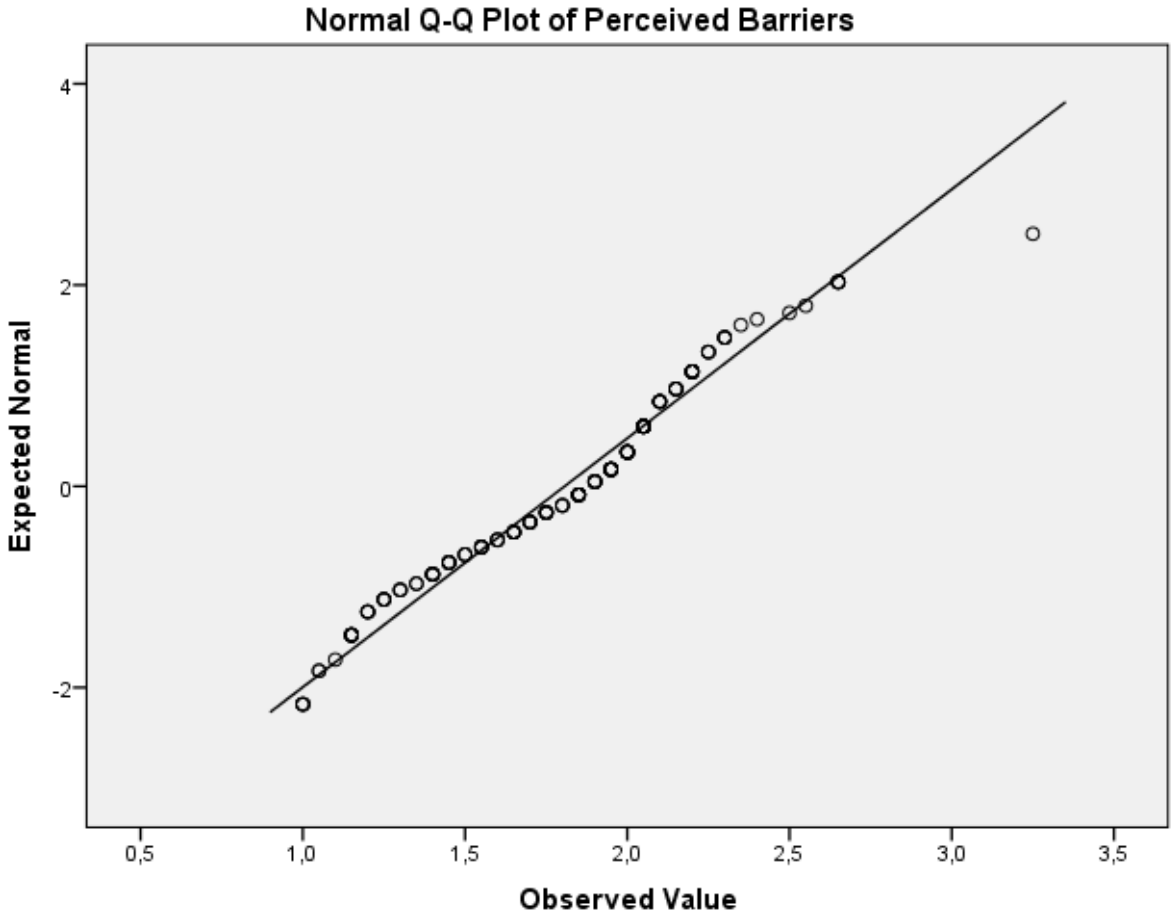
Perceived Benefit

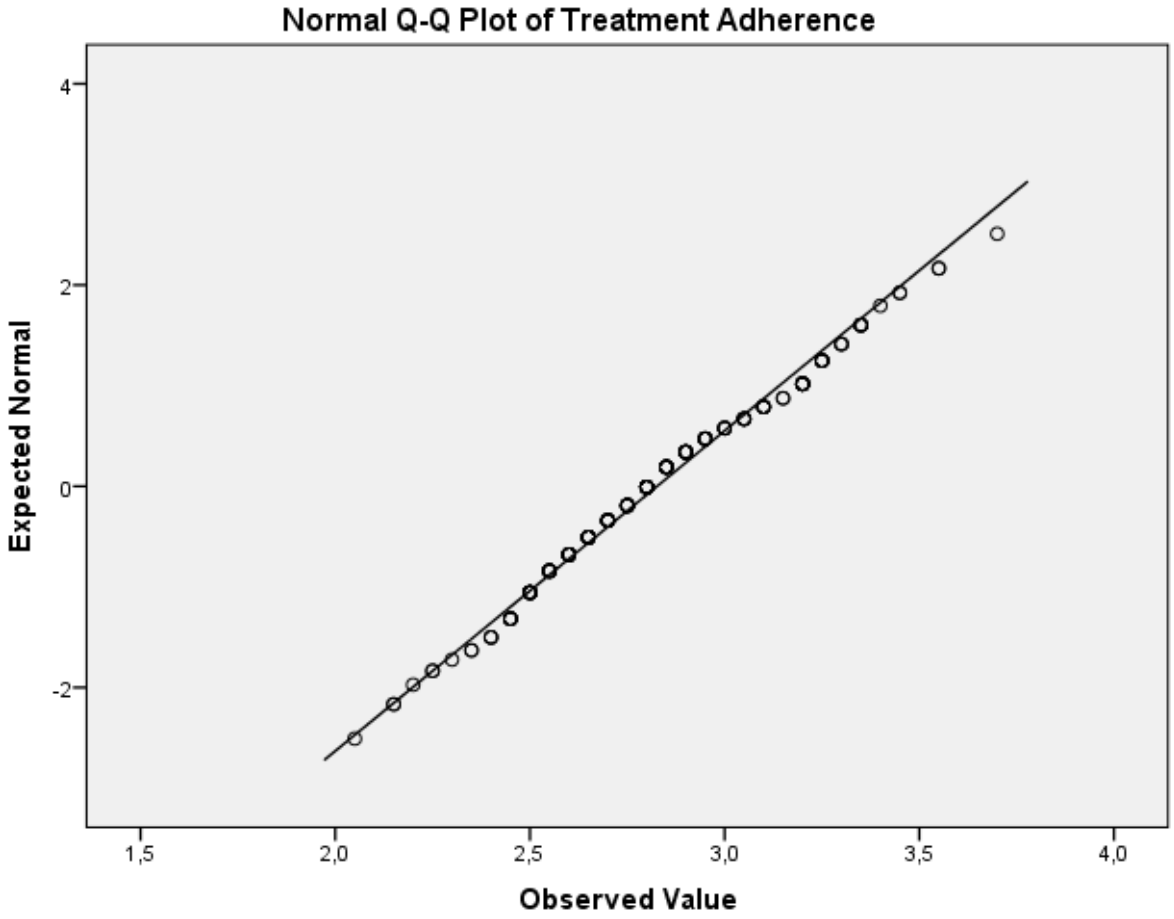


Perceived Barriers




Normal Q-Q Plot of Perceived Benefit
Expected Normal
3
2
1
0
-1
-2
-3
2,5
3,0
3,5
4,0
Observed Value


Normal Q-Q Plot of Perceived Barriers
Expected Normal
Observed Value
4
2
0
-2
0,5
1,0
1,5
2,0
2,5
3,0
3,5


Normal Q-Q Plot of Treatment Adherence
Expected Normal
4
2
0
-2
1,5
2,0
2,5
3,0
3,5
4,0
Observed Value

APPENDIX G

ADDITIONAL RESULTS

The level of Mean. Standard Deviation of the study variables

The levels of the variables of the subjects were found that the mean score of perceived benefit was at a high level (*Mean* = 3.23. *SD*= .66). Perceived barriers (*Mean*= 1.81. *SD*= .73) was at a low level. Treatment adherence (*Mean*= 2.83. *SD*= 0.80) was at a moderate level.

The instrumental perceived benefits of medication adherence of the subjects

All of the instruments of medication adherence items were at a high level with the mean score ranged from 3.22 to 3.39. Among those items. two items have the highest score "I believe that medications will control my blood sugar level" (*Mean*= 3.39. *SD*= .58) and "I believe that the more time I consume my medicine for diabetes the faster my blood sugar will decrease" (*Mean*= 3.38. *SD*= .56)

Table 5. Perceived benefits mean, standard deviations and the levels of instrumental medication adherence of the subject (N= 164).

Medication Adherence	*Mean*	*SD*	Level
1. Medicine for diabetes can prevent the occurrence of diabetes complications.	3.24	0.66	High
2. My glucose level will decrease after consuming medicine for diabetes.	3.33	0.54	High
3. I believe that the more ontime I consume my medicine for diabetes the faster my blood sugar will decrease.	3.38	0.56	High
4. I believe that medications will control my blood sugar level.	3.39	0.58	High
5. Medicine for diabetes will ensure that I will live longer.	3.22	0.64	High

The instrumental perceived benefits of dietary behavior of the subject (N=164)

All dietary behavior items were at a high level with the scores ranged from 3.20 to 3.41. Among those items. two items were the highest "Following diet instruction from health care provider for diabetes mellitus will keep me from having high blood glucose" (*Mean*= 3.41. *SD*=.53) and "Diet instructions from the health care provider enable me to make intelligent choices on healthy foods" (*Mean*= 3.40. *SD*= .51).

Table 6. Perceived benefits mean, standard deviations and the levels of the dietary behavior of the subject (N=164).

Dietary Behavior	*Mean*	*SD*	Level
1. Following diet instruction from health care provider for diabetes mellitus will keep me from having high blood glucose.	3.41	0.53	High
2. My family members always cook my foods according to the instruction given by the health care provider.	3.21	0.63	High
3. Diet instructions from the health care provider enable me to make intelligent choices on healthy foods.	3.40	0.51	High
4. Healthy food can prevent me from developing complications of diabetes in my body.	3.20	0.64	High

The instrumental perceived benefits of physical activity of the subject (N=164)

All physical activity items were at a high level with the scores ranged from 3.27 to 3.40. Among those items. two items were the highest "Regular exercise improves my stamina" (*Mean*= 3.40. *SD*=.50). "Regular exercise decreases my blood sugar level" (*Mean*= 3.33. *SD*= .59)

Table 7. Perceived benefits mean, standard deviations and the levels of physical activity of the subject (N=164).

Physical activity	*Mean*	*SD*	Level
1. Regular exercise decreases my blood sugar level.	3.33	0.59	High
2. Regular exercise improves my stamina.	3.40	0.50	High
3. Regular exercise increases my muscle strength.	3.33	0.51	High
4. I will live longer if I exercise regularly.	3.27	0.57	High
5. Regular exercise can prevent me from developing complications of diabetes in my body.	3.31	0.51	High

The instrumental perceived benefits of self-monitoring blood glucose of the subject

Mostly the self-monitoring blood glucose was at a high level. the scores ranged from 2.17 to 3.24. Among those items one item were at a moderate level " I know how to operate my blood glucose meter tool" (*Mean*=2.17. *SD*=.94). The highest items " I believe self-monitoring blood sugar regularly will help me prevent the occurrence of diabetes complications in my body " (*Mean*= 3.25. *SD*= .94)

Table 8. Perceived benefits mean, standard deviations and the levels of regular self-monitoring blood glucose of the subject (N=164).

Self-monitoring blood glucose	*Mean*	*SD*	Level
1. I know how to operate my blood glucose meter tool.	2.17	0.94	Medium
2. Since blood sugar level is an important factor in diabetes treatment. therefore I am concerned about my blood sugar level.	3.20	0.62	High
3. My family members always monitor my blood sugar level.	3.23	0.58	High
4. I believe self-monitoring blood sugar regularly will help me prevent the occurrence of diabetes complications in my body.	3.24	0.59	High

The instrumental of perceived barriers of medication adherence of the subject (N=164)

All of the instruments of medication adherence items were at a low level with the mean score ranged from 1.50 to 1.90.

Table 9. Perceived barriers mean, standard deviations and the levels of medication adherence of the subject (N=164).

Medication Adherence	*Mean*	*SD*	Level
1. I do not consume my diabetes medicine regularly because I am not at home when it is time to take this medicine.	1.90	0.74	Low
2. I am convinced that it is not important to consume my diabetes medications.	1.50	0.66	Low
3. I think I waste a lot of time just to take my diabetes medications.	1.61	0.59	Low
4. I think diabetes medication is expensive.	1.74	0.69	Low
5. I feel awkward with other people around me when it is time to take my medications.	1.60	0.61	Low

The instrumental of perceived barriers of dietary behavior of the subject (N=164)

All of the instruments of dietary behaviors items were at a low level and medium with the mean score ranged from 1.50 to 1.90.

Table 10. Perceived barriers mean, standard deviations and the levels of the dietary behavior of the subject (N=164).

Dietary Behavior	*Mean*	*SD*	Level
1. I am unsure about the right amount of food I need to consume to maintain good blood sugar level.	2.02	0.74	Moderate
2. I am convinced that it won't matter if I don't follow my diet instructions from the health care providers.	1.70	0.75	Low
3. I am around other people who are eating or drinking things I shouldn't.	2.05	0.72	Moderate
4. The cost of the recommended foods to eat according to meal plan is expensive.	1.90	0.66	Low
5. It needs much time to prepare my foods.	1.70	0.59	Low

The instrumental of perceived barriers to physical activity of the subject (N=164)

All of the instruments of dietary behaviors items were at a low level with the mean score ranged from 1.80 to 1.92

Table 11. Perceived barriers mean, standard deviations and the levels of physical activity of the subject (N=164).

Physical activity	*Mean*	*SD*	Level
1. Exercise tires me.	1.80	0.67	Low
2. Exercise is a hard physical work for me.	1.80	0.72	Low
3. My family members do not encourage me to exercise regularly.	1.70	0.73	Low
4. Places for me to exercise are too far away from my house.	1.84	0.70	Low
5. There are few places for me to exercise.	1.92	0.72	Low

The instrumental of perceived barriers self-monitoring activity of the subject (N=164)

All of the instruments of dietary behaviors items were at a low level with the mean score ranged from 1.70 to 2.61 Table 8.

Table 12. Perceived barriers mean, standard deviations and the levels of regular self-monitoring of the subject (N=164)

Regular self-monitoring blood glucose	*Mean*	*SD*	Level
1. My family has no time to accompany me to test my blood glucose level in the hospital.	1.80	0.72	Low
2. I don't have necessary materials or equipment with me to test my glucose level.	2.61	0.80	Moderate
3. I am convinced that it is not important to check my blood glucose level.	1.70	0.61	Low
4. I feel awkward with other people around me when it is time to take my glucose.	1.72	0.68	Low
5. The cost of materials for testing my blood glucose level is expensive.	1.80	0.69	Low

The instrumental treatment adherence of medication adherence of the subject (N=164)

All of the instruments of medication adherence items were at a high level and medium level with the mean score ranged from 2.6 to 3.2. Among those items. two items have the highest score "I consume my type 2 diabetes mellitus medication within the usual time every day" (*Mean*= 3.2. *SD*= .55). "I take my medications even when I get sick with a high fever or when I have nausea and vomiting" (*Mean*= 3.2. *SD*= .68). and "I still consume my diabetes medication even though I feel well" (*Mean*=3.2. *SD*= .64)

Table 13. Treatment adherence means standard deviations and the levels of instrumental medication adherence of the subject (N= 164).

Medication Adherence	*Mean*	*SD*	Level
1. I consume my type 2 diabetes mellitus medication within the usual time every day.	3.2	0.55	High
2. I take my medications even when I get sick with a high fever or when I have nausea and vomiting.	3.2	0.68	High
3. I still consume my diabetes medication even though I feel well.	3.2	0.59	High
4. I refill your medicines before they run out.	3.0	0.64	High
5. Every time my medications run out I buy new medications in the hospital.	2.6	0.75	Moderate

The instrumental treatment adherence of dietary behavior of the subject (N=164)

All of the instruments of medication adherence items were at a high level and medium level with the mean score ranged from 2.3 to 3.4. Among those items. one item has the highest score "I eat according to the diet instruction from the health provider" (*Mean*= 3.4. *SD*= .56).

Table 14. Treatment adherence means standard deviations and the levels of the instrumental dietary behavior of the subject (N= 164).

Dietary Behavior	*Mean*	*SD*	Level
1. I stay on my diet even when I eat out	3.2	0.54	High
2. I eat according to the diet instruction from the health provider	3.4	0.56	High
3. I eat foods that I should avoid on my diet	2.3	0.85	High
4. I follow all instructions from the health care for my diet	3.3	0.49	High
5. I eat more on those days when I get more exercise than usual	2.3	0.75	Moderate

The instrumental treatment adherence of physical activity of the subject (N=164)

All of the instruments of medication adherence items were at a high level and moderate level and high level with the mean score ranged from 2.36 to 3.3. Among those items. one item has the highest score "I always convince myself that exercise is important for me" (*Mean*= 3.3. *SD*= .62)

Table 14.Treatment adherence means standard deviations and the levels of instrumental physical activity of the subject (N= 164).

Physical activity	*Mean*	*SD*	Level
1. I do exercise every day for 30-60 minutes every day.	2.8	0.71	Moderate
2. Even though the weather is bad I still go for exercise.	2.6	0.85	Moderate
3. Even though the location is not convenient I still go for exercise.	2.9	0.69	Moderate
4. I always convince myself that exercise is important for me.	3.3	0.62	High
5. Even though my shoes are wet I will still go for exercise.	2.8	0.73	Moderate

The instrumental treatment adherence of regular self-monitoring of the subject (N=164)

All of the instruments of medication adherence items were at a high-level moderate level and low level with the mean score ranged from 1.9 to 3.0. Among those items. one item has the highest score "I never feel ashamed even when I have to check my blood sugar in front of other people" (*Mean*= 3.0. *SD*= .55).

Table 15. Treatment adherence means standard deviations and the levels of instrumental regular self-monitoring of the subject (N= 164).

Regular self-monitoring blood glucose	*Mean*	*SD*	Level
1. I check my blood glucose every day.	1.9	0.69	Low
2. I always bring with me the equipment to check my blood glucose everywhere I travel.	1.9	0.82	Low
3. I observe the sign and symptoms of hyperglycemia and hypoglycemia.	2.8	0.65	Moderate
4. I never feel ashamed even when I have to check my blood sugar in front of other people.	3.0	0.55	High
5. I always inform to the hospital and tell the result of my blood sugar levels.	2.8	0.65	Moderate

Relationship Perceived Benefits, Perceived Barriers, and Treatment Adherence

Correlations

		Perceived Benefit	Perceived Barriers	Treatment Adherence
Perceived Benefit	Pearson Correlation	1	-.529**	.690**
	Sig. (2-tailed)		.000	.000
	N	164	164	164
Perceived Barriers	Pearson Correlation	-.529**	1	-.453**
	Sig. (2-tailed)	.000		.000
	N	164	164	164
Treatment Adherence	Pearson Correlation	.690**	-.453**	1
	Sig. (2-tailed)	.000	.000	
	N	164	164	164

**. Correlation is significant at the 0.01 level (2-tailed).

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