CHAPTER II
LITERATURE REVIEW

2.1 Diabetes Mellitus (DM)

2.1.1 Definition

Diabetes mellitus, more commonly called diabetes is a heterogeneous chronic metabolic disorder that is in principle characterized by persistent hyperglycemia due to insulin work defects and/or secretions. Diabetes mellitus consists of a group of chronic metabolic disorders involving major metabolic fuels, carbohydrates, fats and also proteins. This disorder is caused by absolute or relative deficiency of insulin secretion which is often accompanied by insulin work defects (Chandalia, 2014).

Diabetes mellitus is a serious chronic disease that occurs when the pancreas does not produce enough insulin (a hormone that regulates blood glucose), or when the body cannot effectively use the resulting insulin. Insulin is an essential hormone produced in the pancreas. This allows glucose from the bloodstream to enter the body's cells to be converted into energy. Insulin is also important for protein and fat metabolism (IDF, 2019).

Type 2 diabetes mellitus is a metabolic disorder in which the body's cells are resistant to the action of insulin being produced and over time insulin production decreases. Chronic diseases such as diabetes mellitus are particularly susceptible to impaired function in the organs of the eyes, kidneys, nerves, heart and blood vessels (WHO, 2019).

The above definition can be concluded that DM is a disease of insulin function disorder including chronic diseases that cannot be cured and requires serious treatment to prevent complications and improve intervention.
2.1.1 Classification

According to (Muller-Wieland et al., 2019) diabetes can be classified into the following general categories:

2.1.1.1 Type 1 Diabetes Mellitus (T1DM)

T1DM is also known as Juvenile diabetes. Another name of T1DM is insulin-dependent diabetes mellitus (IDDM), which is insulin-dependent diabetes. T1DM is a disease that occurs due to a disorder of the pancreas, where the pancreas is not able to produce insulin optimally. The inoptimality of pancreatic function is caused by the destruction of β cells in the pancreas that play a role in producing the hormone insulin. The cause of damage and destruction of β cells often occurs in autoimmune reactions, namely the immune system that mistakenly recognizes β cells as foreign bodies. These autoimmunity reactions can be triggered by infection of the body. T1DM often occurs in children as well as the age of less than 35 years so called baby diabetes mellitus.

2.1.1.2 Type 2 Diabetes Mellitus (T2DM)

T2DM is also referred to as noninsulin-dependent diabetes (NIDDM), i.e. DM that is not insulin dependent. It is caused because the body's cells do not use insulin as a source of energy or the body's cells do not respond to insulin released by the pancreas, or also called insulin resistance.

2.1.1.3 Gestational Diabetes Mellitus (GDM)

Gestational diabetes mellitus is a diabetes caused by pregnancy conditions. Where the pancreas cannot produce enough insulin to control blood sugar at a level that is safe for the mother and fetus. GDM is usually suffered by pregnant women in the sixth month of pregnancy. This disease needs to be controlled because it is at risk for babies with birth defects such as heart-related, central nervous system, muscle defects, and babies born
weighing over 4 kg or called *macrosomia*. In addition to the risk of the baby being over 4 kg, macrosomia can also be dangerous for a mother because only about 20-25% of women with GDM can survive.

### 2.1.1.4 Diabetes Mellitus due to other diseases

Certain types of diabetes caused by other causes, for example, monogenic diabetes syndrome (such as neonatal diabetes and diabetes that arise at maturity), exocrine pancreatic diseases (such as cystic fibrosis and pancreatitis), and diabetes induced by drugs or chemicals (such as with the use of glucocorticoids, in the treatment of HIV / AIDS, or after organ transplantation).

It is important for service providers to be aware that the classification of diabetes types is not always easy to present, and misdiagnosis can occur. Diagnosis may become clearer over time and should be evaluated if there are concerns.

### 2.1.2 Etiology

#### 2.1.2.1 Insulin-dependent diabetes mellitus

**a. Genetic factors**

Diabetes don’t inherit type 1 diabetes itself but inherit a predisposition or genetic tendency towards the occurrence of type I diabetes. This genetic tendency is determined in individuals who have a specific type of HLA (*Human Leucocyte Antigen*) antigen. HLA is a collection of genes responsible for antigen transplantation and other immune processes.

**b. Immunological factors**

In type 1 diabetes there is evidence of an autoimmune response. This is an abnormal response where the antibody is directed at the normal tissue of the body by reacting to the tissue that it considers as foreign tissue.
2.1.2.2 Non insulin depend diabetes mellitus

The exact cause of T2DM is not yet known, genetic factors are thought to play a role in the process of insulin resistance.

Diabetes mellitus is not insulin-dependent disease has a strong familiar pattern. Diabetes is characterized by abnormalities in insulin secretion as well as in the work of insulin. At first it appears that there is resistance from the target cells to the work of insulin. Insulin first binds itself to certain cell surface receptors, then an intraselluler reaction increases the transport of glucose through the cell membrane. In patients with diabetes there is an abnormality in the binding of insulin with receptors. This can be caused by a reduced number of insulin-responsive receptor places on cell membranes. As a result there is an abnormal merger between the insulin receptor complex and the glucose transport system. Normal glucose levels can be maintained for a long time and increase insulin secretion, but in the end the circulating insulin secretion is no longer sufficient to maintain euglycemia (DeFronzo et al., 2018). T2DM is also called Non Insulin Dependent Diabetes Mellitus which is a group commonly found in adults, but can sometimes arise in childhood.

Risk factors related to the process of occurrence of T2DM, according to (Chandalia, 2014) are:

a. Age (insulin resistance tends to increase at the age of over 65 years)

b. Obesity
c. Family history

2.1.3 Pathophysiology

Most pathological images of DM can be associated with one of the main effects due to the following lack of insulin:

2.1.3.1 Reduced use of glucose by the body's cells resulting in an increase in blood glucose concentration as high as 300 - 1200 mg / dl.

2.1.3.2 Increased fat mobilization of fat storage areas that cause abnormal fat metabolism accompanied by cholesterol deposits on the walls of blood vessels.

2.1.3.3 Reduced protein in body tissues.

Patients with insulin deficiency were unable to maintain normal fasting plasma glucose levels or tolerance after meals. In severe hyperglycemia that exceeds the normal renal threshold (blood glucose concentration of 160 – 180 mg/100 ml), glucosuria will arise because the renal tubules are unable to reabsorb all glucose. This glucosuria will result in osmotic diuresis that can cause polyuria accompanied by loss of sodium, chloride, potassium, and pospat. The presence of polyuria causes dehydration and polydipsi. As a result of glucose coming out with urine, the patient will experience a negative protein balance and weight loss and tend to occur polyphagy. Another result is astenia or lack of energy so that the patient becomes rapidly and drowsy caused by reduced or loss of body protein and also reduced use of carbohydrates for energy (DeFronzo et al., 2018).

2.1.4 Clinical Manifestation

According to (Muller-Wieland et al., 2019) symptoms that commonly occur in diabetes mellitus in the early stages are often found as follows:

2.1.4.1 Poliuri (frequent urination)

DM is usually characterized by high blood sugar levels above 160-180 mg / dl so that it will get to the urine. Glucose that
reaches the urine if it increases high will trigger the kidneys to dispose of additional water to dilute the glucose because of the sugar properties that attract water resulting in polyuria or a lot of urine.

2.1.4.2 Polydipsi (drinking a lot)
This is due to burning too much and losing a lot of fluid due to polyuri, so to balance should drink more.

2.1.4.3 Polypagi (eating a lot)
This is because glucose does not reach the starvation cells (hungry). So to meet it is recommended to continue eating. But even if you eat a lot, it will only reach the blood vessels.

2.1.4.4 Weight loss, weakness and fatigue
This is due to running out of glycogen that has been melted into glucose, then the body tries to get a melting of substances from other parts of the body, namely fat and protein, because the body continues to feel hungry then the body including those in muscle tissue and fat so that patients with DM eat a lot will remain thin.

2.1.4.5 Blurred eyes
This is caused by cross interference (glucose-sorbitol fructation) caused by insulin insufficiency. As a result there is a hoarding of sorbitol from the lens, causing cataract formation.

2.1.5 Management
Diagnosis of diabetes can never be established without estimation of blood glucose / plasma. However, urinalysis may also be very useful in providing indications for its diagnosis, facilitating control and treating some of its complications.

According to (DeFronzo et al., 2018), there are 4 pillars of DM management, namely education, medical nutrition therapy, physical exercise, and pharmacological interventions.

2.1.5.1 Education
Education is a comprehensive effort to increase patient knowledge and motivation in achieving behavioral changes. The purpose of behavior change is so that people with diabetes can lead a healthy lifestyle. Education can be done individually with an approach based on problem solving.

2.1.5.2 Medical nutrition therapy

The objectives of medical nutrition therapy are:

a. To achieve optimal outcomes and maintain them. Optimal metabolic outcomes include normal glucose levels, favorable lipid profiles, and acceptable blood pressure levels to reduce the risk of macro and micro vascular disease.

b. To prevent and overcome chronic DM complications by changing nutrient intake and lifestyle to align for the prevention and treatment of obesity, dyslipidemia, cardiovascular disease, hypertension, and nephropathy.

c. To improve health through the selection of healthy foods and physical activity.

2.1.5.3 Physical exercise

Daily physical activities and regular exercise (3 - 4 times a week for approximately 30 minutes), is one of the pillars in the management of DM. Physical exercise to maintain fitness and can lose weight and insulin sensitivity, so it will improve blood glucose control.

2.1.5.4 Pharmacological interventions

Pharmacological therapy is administered in conjunction with eating arrangements and physical exercise (lifestyle). Pharmacological therapy consists of oral drugs (Oral Hypoglycemic Drugs) and injection forms. Oral hypoglycemic drugs are necessary in the treatment of T2DM if lifestyle interventions with diet, and physical exercise is not enough to control hyperglycemia. The combination of insulin with oral
hypoglycemic drugs helped to achieve control of glycemia levels in patients who showed an optimal response to oral hypoglycemic drugs alone.

2.1.6 Complication
Complications arising from DM disease include (Weerarathna et al., 2018):

2.1.6.1 Acute
Includes coma hypoglycemia, ketoacidosis, and Hyperglycemic coma Nonketotic Hyperosmolar (HHNK). Coma hypoglycemia occurs due to continuous insulin therapy, ketoacidosis occurs due to the continuous process of fat breakdown that produces byproducts in the form of ketone objects that are toxic to the brain, while HHNK coma occurs due to hyperosmolarity and hyperglycemia that causes loss of fluids and electrolytes resulting in changes in consciousness levels.

2.1.6.2 Chronic
Includes macrovascular (regarding large blood vessels such as heart blood vessels, peripheral blood vessels, and brain blood vessels), microvascular (regarding small blood vessels: diabetic retinopathy, diabetic nephropathy), diabetic neuropathy, susceptible to infection, and diabetic legs. The most common and most important complication is peripheral neuropathy in the form of loss of distal sensation and a high risk for diabetic ulcers and amputations.

2.2 Family Support Concept

2.2.1 Family Support
The family is one of the oldest and most universal social institutions. It can have a strong influence on individuals in terms of health and disease experiences, as families play a key role in the care and socialization of
young people and are important as a source of nursing care, care and information about health and disease (Wray, 2016).

Family support is the attitude, actions and acceptance of the family towards its members. Family members see that supportive people are always ready to provide help and assistance if needed (Wray, 2016).

According to (Krystalia, 2017) family support is a help provided by other family members so that it will provide physical and psychological comfort to someone experiencing stressful situations.

2.2.2 Family Function

According to (Friedman, 2010) there are 5 basic functions of the family:

2.2.2.1 Affective function
The function of maintaining personality, which means facilitating the stabilization of the adult personality, meeting the psychological needs of family members.

2.2.2.2 Social Function
Facilitating primary socialization of family members aimed at making productive family members and giving status to family members.

2.2.2.3 Reproductive Function
Maintaining continuity for generations and for the survival of society.

2.2.2.4 Economic Function
Provide sufficient economic resources and their effective allocation.

2.2.2.5 Health Care Function
Provide physical needs, food, shelter and health care.

2.2.3 Family Task
According to (Lenny, 2010) there are eight main tasks for the family as follows:

2.2.3.1 Physical care of the family and its members,
2.2.3.2 Maintenance of existing resources in the family,
2.2.3.3 The division of duties of each member according to their respective positions,
2.2.3.4 Socialization between family members
2.2.3.5 Setting the number of family members
2.2.3.6 Maintenance of order in family members,
2.2.3.7 Generating encouragement and enthusiasm of its members.

2.2.4 Support Type
(Kaakinen & Robinson, n.d., 2018) explain that families have some types of support, namely:

2.2.4.1 Informational support
The family serves as a collector and disseminator of information about the world. Explaining about advising, suggesting, information that can be used reveals a problem. The benefit of this support is that it can suppress the appearance of a stressor because the information provided can contribute a special suggestion action to the individual. Aspects of this support are advice, suggestions, suggestions, instructions and information.

2.2.4.2 Assessment support
The family acts as a feedback guidance, guiding and mediating problem solving, as a source and validator of the identity of family members including providing support, appreciation, attention.

2.2.4.3 Instrumental support
Family is a source of practical and concrete help, including: the health of sufferers in terms of food and drink needs, rest, avoidance of fatigue.

2.2.4.4 Emotional support
Family as a safe and peaceful place to rest and recovery and help mastery of emotions. Aspects of emotional support include
support embodied in the form of affection, trust, attention, listening and being listened to.

2.2.5 Resources of Family Support

Family social support refers to social support that is seen by the family as accessible or family-friendly (social support can or may not be used, but family members see that supportive people are always ready to provide help and assistance if needed). Family social support can be internal family social support, such as support from husband or wife as well as support from siblings or external family social support (Kaakinen & Robinson, n.d., 2018).

2.2.6 Family Support Benefits

Family social support is a process that occurs throughout life, the nature and type of social support varies in different stages of the life cycle. Nevertheless, in all stages of the life cycle, family social support makes the family able to function with a variety of cleverness and resourcefulness. As a result, it improves the health and adaptation of the family (Kaakinen & Robinson, n.d., 2018).

2.2.7 Factors Affecting Support

(Wray, 2016) states that there are several factors that affect whether a person will receive support or not. These factors include:

2.2.7.1 Recipient factor

A person will not receive support from others if they do not like to socialize, do not like to help others, and do not want others to know that he or she needs help. Some people sometimes aren't assertive enough to understand that she actually needs help from others, or feel that she should be independent and not bother others, or feel uncomfortable when others help her, and don't know why she should ask for help.

2.2.7.2 Providers factors
A person sometimes does not provide support to others when he or she alone does not have the resources to help others, or is facing stress, has to help himself, or is less sensitive to his surroundings so as not to realize that others need support from him.

2.3 Dietary Compliance

2.3.1 Definition of compliance

Compliance is a concrete action to follow rules or procedures in an effort to change individual attitudes and behaviors (Weerarathna et al., 2018). Compliance is the extent to which the patient's behavior is in accordance with the provisions provided by the health professional (Djamaluddin et al., 2020). Compliance is a change in behavior from behavior that does not comply with regulations to behavior that adheres to regulations (Han et al., 2020).

Obedience concerns the willingness and ability of individuals to follow healthy ways relating to counsel, established rules and following schedules.

2.3.2 Factors affecting compliance

Factors that affect compliant behavior are determined by three main factors according to (Mead, 2012), namely:

2.3.2.1 Predisposing factors

Predisposing factors are factors that facilitate or predispose the occurrence of one's behavior, among others:

a. Trust

Trust or religion is a spirited dimension that can lead to life. Sufferers who hold fast to their religion will have a stoic soul and not easily discouraged fiber can accept the situation, as well as the way it will be better. The willingness to control the disease can be influenced by the trust of sufferers where
patients who have strong beliefs will be more obedient to recommendations and prohibitions.

b. Attitude
Attitude is the most powerful thing in an individual. The desire to maintain his health is very influential to the factors related to the behavior of sufferers in disease control.

c. Knowledge
Patients with low adherence are those who are not identified as having symptoms of illness. They think that he is healed and healthy so that there is no need to control his health.

2.3.2.2 Reinforcing factor
Reinforcing factors are factors that encourage or strengthen the occurrence of behavior manifested in one's attitudes and behaviors, among others:

a. Health care support
Support from health workers is very much meaningful for sufferers because the officer is the manager of the sufferer who interacts most often so that the understanding of physical and psychic conditions better, by interacting frequently, greatly affects the trust and always accept the presence of health workers in accordance with the recommendations given.

b. Family Support
The family is part of the closest and inseparable sufferer. Sufferers will feel happy and peaceful if they get attention and support from the family, because with the support will raise their confidence to face or manage the disease well, and the sufferer will obey the suggestions given by the family to support the management of the disease.

2.3.2.3 Enabling factor
Factors that allow or facilitate behavior and action. What is meant by possible factors are facilities and infrastructure or facilities for the occurrence of health behaviors, such as health centers, hospitals, posyandu, landfills, sports venues, nutritious food, and so on.

2.3.3 Adherence to diabetes mellitus diet

Dietary compliance is one of the keys to success in the administration of DM disease. This is because meal planning is one of the 4 main pillars in DM management.

According to (Han et al., 2020) Dietary compliance is a major problem that occurs in DM sufferers. This is supported by (Sami et al., 2017) who say that diet is the most difficult habit to change and the lowest level of compliance in self-management of a DM sufferer.

DM diet administration includes three main things that must be implemented by DM sufferers, namely the amount of food, type of food, and meal schedule.

2.3.3.1 Amount of food

In general, the regulation of the amount of food is made based on height, weight, type of activity, and also age. Based on this, it will be calculated and determined the number of calories for each sufferer. The amount of foodstuffs a day for the standard diet of diabetes mellitus is expressed in exchange units.

Table 2.1 Number of Food Ingredients a Day According to DM Diet Standards

<table>
<thead>
<tr>
<th>Foodstuffs</th>
<th>1100 kcal</th>
<th>1300 kcal</th>
<th>1500 kcal</th>
<th>1700 kcal</th>
<th>1900 kcal</th>
<th>2100 kcal</th>
<th>2300 kcal</th>
<th>2500 kcal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice/exchanger</td>
<td>2.5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5.5</td>
<td>6</td>
<td>7</td>
<td>7.5</td>
</tr>
<tr>
<td>Fish/exchangers</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Meat/exchanger</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2.2 Types of Food Ingredients Recommended For DM Sufferers

<table>
<thead>
<tr>
<th>No</th>
<th>Types of Groceries</th>
<th>Food Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Complex carbohydrates</td>
<td>Rice, bread, noodles, potatoes, cassava and sago</td>
</tr>
<tr>
<td>2</td>
<td>Low fat protein</td>
<td>Fish, skinless chicken, skimmed milk, tofu, tempeh, nuts</td>
</tr>
</tbody>
</table>
3 Fat (in limited quantities)  Food processed by roasting, steaming, boiling and burning

Source: (Mead, 2012)

Table 2.3 Types of Food Ingredients that Should Be Avoided / Restricted For DM Sufferers

<table>
<thead>
<tr>
<th>No</th>
<th>Types of Food</th>
<th>Food Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lots of sugar</td>
<td>Granulated sugar, javanese sugar, syrup, jelly, preserved fruit, sweetened condensed milk, soft bottled beverages, dodol and ice cream</td>
</tr>
<tr>
<td>2</td>
<td>Lots of fat</td>
<td>Cake, ready meals, fritters</td>
</tr>
<tr>
<td>3</td>
<td>Lots of sodium</td>
<td>Salted fish, salted eggs, preserved food</td>
</tr>
</tbody>
</table>

Source: (Mead, 2012)

2.3.3.3 Meal schedule

Meal schedule is a fixed meal time which is breakfast, lunch and dinner at 7.00-8.00, 12.00-13.00, and 17.00-18.00, and interspersed at 10.30-11.00 and 15.30-16.00. Scheduling is done with time discipline in order to help the pancreas secrete insulin regularly. Basically diet on DM is given with 3 staple meals, 2-3 interspersed meals with a time interval of 3 hours (Cramer, 2013).

2.4 Conceptual Framework

Concept framework is a description of the relationship between variables related to research problems and is built on the theoretical framework or the results of previous studies as a research guideline. The concept framework is part of the theoretical framework to be researched, to describe it clearly with dependent variables and independent variables (Melzer, 2019), Independent and Dependent concept framework.
2.5 **Hypothesis**

The research hypothesis is a predictive statement relating to independent variables with dependent variables (Kothari, 2019).

Respondents who have good family support then adherence to their diet tends to be good. This is due to the motivation of the family that makes respondents feel valued, cared for, loved and have the confidence to recover. Similarly, if family support is low then the respondent has no motivation to recover and there is no desire to improve their health.

Over time, the family is the main source of DM patients in carrying out self-management at home. One of the functions of the family according to Wray (2016) is family care, the ability of the family to perform nursing care or health care affects the health status of the family and individuals. Regardless of the type of chronic disease suffered, families are challenged to help family members stay healthy, prevent complications, and to manage complications, include physical and mental changes in the role of family function, and to manage complications or disabilities.

Ha: There is a correlation between family support and diet compliance in type 2 diabetes mellitus patients at the diabetic foot polyclinic.