CHAPTER 2

LITERATURE REVIEW

The review of the literature is presented for discussion in two sections. The first section presents diabetes mellitus type 2, treatments and standard care. The second section describes the Self-Efficacy theory, Diabetes Self-management, and research studies related to diabetes self-management interventions, physiological outcomes, and quality of life among people with type 2 diabetes.

Diabetes Mellitus Type 2

Diabetes mellitus is associated with abnormalities in carbohydrates, fats, and protein metabolism. Several pathogenic processes are involved in the development of diabetes. Deficient insulin action resulting from inadequate insulin production and /or diminished tissue responses to insulin in the complex pathways of hormone action are the causes of hyperglycemia. An Expert Committee defined the categories of fasting plasma glucose (FPG) values as: normal fasting glucose (FPG < 100 mg/dl); stage 1 Impaired Fasting Glucose (IFG) (FPG = 100-109 mg/dl); stage 2 IFG = 110-125 mg/dl; and provisional diagnosis of diabetes (FPG ≥ 126 mg/dl) (ADA, 2003; Nichols & Brown, 2005). The corresponding categories when the oral glucose tolerance test (OGTT) is used are as follows: normal glucose tolerance (2-hour post load glucose [2-h PG] < 140 mg/dl (7.8 mmol/l), impaired glucose tolerance (IGT) (2-h PG ≥ 140 (7.8 mmol/l) and < 200 mg/dl (11.1 mmol/l); and provisional diagnosis of diabetes

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(the diagnosis must be confirmed) (2-h PG $\geq$ 200 mg/dl (11.1 mmol/l) that is although the glucose levels do not meet the criteria for diabetes, it is nevertheless too high to be considered normal (The Expert Committee on the Diagnosis and Classification of diabetes mellitus, 2003). The types of diabetes proposed by newly etiological classification are divided into four subclasses:

1). Type 1 diabetes (previously encompassed by the terms insulin dependent diabetes mellitus [IDDM], type I diabetes, or juvenile-onset diabetes), the cause of which is β-cell destruction that leads to diabetes which requires insulin for survival, such as immune-mediated diabetes mellitus (a cell-mediated autoimmune destruction of a pancreatic β-cells, or insulin autoantibody that is associated with β-cell destruction), and idiopathic that has no evidence of autoimmunity but has permanent insulinopenia, and requires insulin replacement therapy (Zimmet, Cowie, Ekoe, & Shaw, 2004).

2). Type 2 diabetes (non-insulin dependent, NIDDM, type II diabetes, or adult-onset diabetes). The cause of which is disorders of insulin resistance and insulin secretion, but autoimmune destruction of the pancreas does not occur.

3). Other specific types of diabetes such as genetic defect of the β-cells or defects in insulin action are underlying defects or genetic disease, exocrine pancreatic, endocrine, and drug-induced causes, such as genetic defects of β-cell function, genetic defects in insulin action, disease of the exocrine pancreas, endocrinopathies, chemical-induced diabetes, or infections.

4). Gestational diabetes mellitus which results in hyperglycemia of variable severity with onset or recognition during pregnancy (The expert committee on the diagnosis and classification of diabetes mellitus, 2003; Zimmet et al., 2004).

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Importantly, type 2 diabetes comprises around 90% of all cases of diabetes mellitus. It may be asymptomatic until complications have occurred (Ridgeway et al., 1999).

Type 2 diabetes is a disease process where individuals have insulin resistance and usually have a relative insulin deficiency (Reaven, Bernstein, Davis, Olefsky, 1976; Olefsky, Kolterman, & Scarlett, 1982). With insulin resistance, the insulin produced by the pancreas cannot connect with fat and muscle, thereby not allowing the glucose to enter the cell and produce energy. The second condition is an insulin secretory defect. The defect leads to increased hepatic gluconeogenesis, which produces fasting hyperglycemia. To compensate, the pancreas produces more insulin. The cells sense this flood of insulin and become even more resistant, resulting in a cycle of high glucose levels and often excessive levels of insulin, eventually followed by a drop in insulin production. At the beginning, the amount of insulin is usually sufficient to overcome such resistance. The condition in which people have an abnormal rise in blood glucose after a meal is called postprandial hyperglycemia. However, the pancreas finally becomes unable to produce enough insulin to overcome resistance over time (Polonsky, Sturis & Bell, 1996). People with type 2 diabetes retain the ability to secrete some insulin. Therefore, they are considered to require insulin for adequate glycemic control. People with this type of diabetes can survive without insulin (Zimmet et al., 2004).

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Type 2 diabetes typically occurs in people older than 40 years who have a family history of diabetes. Genetics play a large role in type 2 diabetes and family history is a risk factor. Most people with this form of diabetes are usually obese, particularly at the time of diagnosis, and obesity itself causes some degree of insulin resistance (Bogardus, Lillioja, Mott, Hollenbeck, & Reaven, 1985; Kolterman, Insel, Saekow, & Olefsky, 1981). People who are not obese by traditional weight criteria may have an increased percentage of body fat distributed predominantly in the abdominal region (Kissebah et al., 1982). Being over weight (BMI ≥ 25kg/m^2 for people in western countries, and BMI ≥ 23kg/m^2 for Asian people) increases the risk factors of type 2 diabetes (ADA, 2003). However, the disease can also develop in lean people, especially in the elderly. In addition, habitual physical inactivity, poor diet, history of gestational diabetes mellitus or delivery of a baby weighing more than nine pounds, polycystic ovary syndrome, history of vascular disease such as hypertension (≥ 140/90 mmHg in adults), HDL cholesterol ≤ 35 mg/dl, and/or a triglyceride ≥ 250 mg/dl are risk factors for type 2 diabetes (ADA, 2003). People with type 2 diabetes frequently go undiagnosed for several years because hyperglycemia develops gradually. Importantly, symptoms at earlier stages of type 2 diabetes are often not severe enough for these people to notice any of them (Harris, 1989). However, such people with type 2 diabetes are at increased risk of developing macrovascular and microvascular complications (Anderson & Svaardsudd, 1995). Insulin secretion is defective in these people and insufficient to compensate for the insulin resistance.

Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, polyphagia, and blurred vision. Susceptibility to certain infections may also accompany chronic hyperglycemia. Acute life-threatening consequences of diabetes are hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome. Long term complications of diabetes include both microvascular and macrovascular diseases. Microvascular diseases include retinopathy with potential loss of vision or blindness, nephropathy leading to end stage renal disease, peripheral neuropathy with risk of foot ulcers and lower extremity amputations. Diabetic patients also have an

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increased incidence of atherosclerotic cardiovascular, peripheral vascular and cerebrovascular diseases. Macrovascular diseases account for a two to four-fold increased risk for heart disease and stroke (Berg, 2004). Heart disease is the leading cause of death in people with diabetes, approximately 75% of all diabetes related deaths are due to heart attracts or strokes (Unger, 2003). Elevated blood glucose is an independent risk factor for cardiovascular disease (CVD) (Berg, 2004). CVD is responsible for 65% of deaths in American people with type 2 diabetes (Gavin et al., 2003), and was reported as the major cause of death accounting for 50% of total mortality in type 2 diabetic Thai patients (Leelawattana., Rattarasarn, Lim, Soonthornpun, & Setasuban, 2003). The major risk factors for CVD are cigarette smoking of any amount, elevated blood pressure, elevated serum total cholesterol and LDL-cholesterol, low serum HDL-cholesterol, diabetes mellitus, and advancing age (Grundy, Pasternak, Greenland, Smith, & Fuster, 1999). Many researcher and clinicians believe that the summation of grade risks provides advantages over the addition of categorical risk factors. The uses of grade risk factors have been recommended in risk management guidelines developed by joint European societies in cardiovascular fields. The emotional and social impacts of diabetes and the demands of therapy may cause significant psychosocial dysfunction in patients and their families, and also have an influence on their quality of life.

A longitudinal study about predictors of glycemic control among patients with type 2 diabetes conducted by Benoit, Fleming, Philis-Tsimikas, and Ji (2005) reported that patients who had diabetes for a longer period of time indicating poorer glycemic control. Another factor relating poor glycemic control includes used insulin or multiple oral agents, or had high cholesterol as well as higher hemoglobin A_{1c}

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(HbA_{1c}) values over time. In addition, the younger patients had poorer control than the older patients.

Diabetes mellitus requires continuing medical care and patient self-management education for preventing acute complications and decreasing the risks of long-term complications (ADA, 2003). The Endocrine Society of Thailand (2003) stated that the purposes of diabetes treatment include reducing signs and symptoms of hyperglycemia, preventing or reducing acute and chronic complications, and improving quality of life of people with diabetes.

Treatments and Standard Care

Standard diabetes management now focuses on appropriate treatments and standard care for reducing the mortality rates, comorbidities, and psychosocial problems which have to be cost-effective for achieving quality of life or well-being. The corner stone of type 2 diabetes treatments are nutritional management and exercise to reduce glycemia and CVD risk. If nutrition therapy, exercise and lifestyle modification do not result in the desired control of hyperglycemia, oral anti - diabetic agents are added either in the form of monotherapy or a combination therapy. Insulin can also be used for treatment after failure of oral medication (Horton, 1997). Research findings reported that the majority of people with diabetes in Thailand had been advised to modify their diet (85.1%), increase exercise (78.7%), and lose weight (63.8%). The medical regimen reported were using oral glucose-lowering drug (81.9%), using insulin therapy (2.8%), and other treatment such as Chinese medicines or herbs (31.3%). Individuals who had diabetes and blood pressure higher than 140/90 mmHg were prescribed blood pressure-lowering therapy (66.6%) (Aekplakorn et al., 2003). The

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components of treatment and standard care will be focused on medication therapy and behavioral control.

Medication therapy

Sulphonylureas are sulfonamide derivatives such as: (a) the first generation: tolbutamide (Orinase®, Rastinon®) and chlorpopamide (Diabinese®, Diabeedol®, Dibin®, Glycemin®, Propamide®), and (b) the second generation: glybenclamide (Daonil®, Dibelet®, Euglucon®), glypizide (Glucotrol®, Glucotrol XL®), Glyburide (Micronase®, Diabeta®, Glynase®), and glimerpiride (Amaryl®) (Guthrie & Guthrie, 1997). The main effect of sulfonylurea is to improve glycemic control by reducing fasting and non-fasting blood glucose levels. These sulfonylurea drugs vary in potency and duration of action but they have similar mechanism of action, which stimulate insulin secretion from the β-cells in the pancreas in response to glucose. Sulfonylurea also increases the peripheral uptake of glucose by increasing regulation of cell membrane receptor for hormone insulin. In addition, sulfonylurea affects blood glucose level by inhibiting gluconeogenesis and glycogenolysis in human liver (White & Campbell, 1996). The blood glucose lowering effect of sulfonylureas is achieved by increasing plasma insulin concentrations (Horton, 1997).

The first generation drugs concentrate on exerting the greatest effect by stimulating insulin release with a lesser effect on insulin receptors, and essentially no post-receptor effect. They are rarely used at present since they are carried in plasma bound to albumin, which can create serious toxic effects by drug-drug interactionfrom other drugs that are carried the same way (Guthrie & Guthrie, 1997).

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The second generation drugs have advantages over the first generation drugs by stimulating insulin secretion, and have long-term effects by stimulating insulin receptors, as well as producing some post-receptors effects. Second generation drugs are transported in the plasma nonionically bound to albumin. Therefore, they do not compete for binding sites with other drugs. That means they are safer to use than the first generation drugs, especially for older patients who have comorbid disease and are taking multiple drugs for other conditions (Guthrie & Guthrie, 1997). The recommendations for using sulfonylureas is that sulfonylureas therapy should be started with the lowest effective dose and titrate upward at 1-2 weekly, or 3-4 weekly intervals until glycemic control is achieved. Sulfonylureas have significant effects of hypoglycemia and weight gain. The duration of action is important as it may relate to the probability of adverse effects, and relates to the issue of discontinuous sulfonulureas exposure. The short acting sulfonylureas include glipizide (1-5 hours), glibornuride (5-12 hours), gliclazide (6-15 hours), glimepiride (5-9 hours), tolazamide (4-7 hours), and tolbutamide (6-12 hours). The primary indication for sulfonylureas therapy is type 2 diabetes in which optimum blood glucose control is not achieved using dietary and exercise management, insulin allergy or hypersensitivity, or severe in insulin resistance (Lebovitz & Melander, 2004).

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Biguanides are introduced for clinical use in type 2 diabetes therapy. Metformin (Glucopange®) is the biguanide commonly used for type 2 diabetes. It acts as an antihyperglycemic agent by decreasing hepatic glucose production and increasing glucose uptake in skeleton muscles. Metformin requires the presence of insulin to be effective. Most common adverse events with metformin therapy are gastrointestinal effect such as mild to moderate diarrhea (Horton, 1997), metallic taste, nausea, vomiting, anorexia, and a decreased absorption of vitamin B_{12} and folic (Guthrie & Guthrie, 1997). The starting dosage is 500 mg once or twice a day after meals. The dosage is increased in 500 mg increments until the use of 850 mg three times a day is reached (Guthrie & Guthrie, 1997). In clinical trials, metformin monotherapy reduced FPG by 52 - 92 mg/dl and reduced A_{1c} by 1.4 - 2.0% over the dose range of 1,700 - 2,550 mg a day. The majority of these trials used over weight or obese people with type 2 diabetes in whom glycemic control was inadequate with dietary management (Lebovitz & Melander, 2004).

Alpha-glucosidase inhibitor: Acarbose (Precose®) affects the small intestine to slow the breakdown of carbohydrates into absorbable monosaccharides. It acts by decreasing postprandial glucose without causing hyperinsulinemia. Its side effects are abdominal pain, diarrhea, or flatulence. It does not cause hypoglycemia, lactic acidosis, or weight gain. The starting dosage is 25 mg three times a day for minimizing flatulence. This dosage might be maintained for approximately one month before increasing to therapeutic dosage (Guthrie & Guthrie, 1997). For patients who are 60 kilograms or less, the dosages of 50 mg three times after meal are recommended. Patients who weight over 60 kilograms would be expected to take 100 mg of Acabose three times a day. This drug is not recommended for patients who have renal dysfunction, inflammatory bowel disease or ulceration, or partial intestinal obstruction (Guthrie & Guthrie, 1997).

Bajaj and DeFronzo (2004) proposed that the oral hypoglycemic agents should be chosen to initiate therapy to reduce HbA_{1c} to $\leq$ 6.5-7%, if the glycemic control goal is not successful, the two oral agents or combination drugs

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should be considered. If blood glucose is still high although the highest dose of oral hypoglycemic drugs is used, insulin therapy should be considered.

Insulin therapy is needed when the treatment with diet, exercise, and oral antidiabetic agents are insufficient to achieve acceptable glycemic control in patients with type 2 diabetes. Insulin is indicated as initial therapy in specific patients who have type 2 diabetes with a markedly elevated fasting plasma glucose level (> 280-300 mg/dl), and ketonuria or ketonemia (Bajaj & DeFronzo, 2004). At the first step, intermediate-acting insulin such as Neutral Protamine Hagedorn (NPH) is commonly recommended at bed time and with the dose adjusted to reduce overnight hepatic glucose production and achieve a normal, or near normal, fasting blood glucose concentration. Oral hypoglycemic agents are still used to achieve glycemic control during the day. A single dose of an intermediate-acting insulin before supper also works well in combination with oral hypoglycemic agents. If this regimen does not achieve the desired goal, insulin therapy will be entirely used without oral hypoglycemic agents. Common regimens about insulin therapy are to give extended insulin twice a day plus regular insulin before meals. The starting dosage is 1/3 to 1/2 unit/kg of ideal body weight per day in divided doses. The dosage can then be adjusted as needed to improve blood glucose control to a near normal level (Guthrie & Guthrie, 1997). Insulin therapy may require very high doses (> 100 unit/day) for people with type 2 diabetes (Bajaj & DeFronzo, 2004). The side effects of insulin regimens are weight gain and hypoglycemia (The United Kingdom Prospective Diabetes Study [UKPDS] Group, 1998).

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Appropriate medical management is crucial for the delay or prevention of long-term complications in improving metabolic control; however, medical management alone is not sufficient. Ongoing self-management is an essential standard of care, and must be considered to help people with diabetes become knowledgeable about their diseases, skillful in self-management, and entrusted about pursuing effective diabetes self-management. The successful management of diabetes with a goal of achieving near normo-glycemia requires sustain lifestyle changes and coordination of therapeutic regimens. The ADA (2003) recommended that management for people with diabetes should be individualized and coordinated with their families, physician, and other health care providers. Importantly, diabetes self-management education should be recognized as an integral part of the care, including problem solving, and a variety of strategies to provide adequate education and development of problem solving skills in the various aspects of diabetes management to achieve glycemic control and reduce the risk of complications associated with diabetes (Zimmet et al., 2004).

Glycemic control is most important to diabetes management in preventing or retarding the progression of complications in people with diabetes. Glycated haemoglobin or glycosylated haemoglobin (HbA_{1c}) is used as assays to interprete the glycemic control result (Coleman, Goodall, Garcia-Webb, William, & Dunlop, 1997). The term "glycosylated hemoglobin" refers collectively to a series of stable compounds that are formed between hemoglobin and glucose. Glycosylated hemoglobin forms slowly and non-enzymatically when hemoglobin is exposed to plasma glucose. Their concentration is increased within erythrocytes of patients with diabetes mellitus. The level of hemoglobin A_{1C} (HbA_{1C}) is proportional to the level of serum glucose over a

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period of two months. Thus, HbA_{1C} is considered to be an indicator of the mean daily blood glucose concentration when tested over the previous 2 month period. The HbA_{1C} level < 7% is considered as a good glycemic control (ADA, 1999; 2003; 2004; Lu et al., 2004).

Higher glucose levels result in elevated A_{1c} levels because erythrocytes are freely permeable to glucose. The United Kingdom Prospective Diabetes Study (UKPDS) found that lowering the A_{1c} level by a mean of 0.9% for a median follow-up of ten years after diagnosis of type 2 diabetes was associated with relative risk reduction of 12% for diabetes-related end point ($p < .05$), 25% for microvascular end points ($p < .01$), 16% for myocardial infarction ($p = .052$), 24% for cataract ($p < .05$), 21% for retinopathy at 12 years ($p < .05$), and 33% for albuminuria at 12 years ($p < .0001$) (Gavin et al., 2003). The clinical significant as recommended by the UKPDS 35 is 1% reduction of HbA_{1C} (Stratton et al., 2000). In addition, the Diabetes Control and Complications Trial (DCCT) demonstrated that improved glycemic control reduced the risk of developing retinopathy and nephropathy and possibly reduces neuropathy (Zimmet et al., 2004). The criteria for successful treatment in glycemic control, which is considered clinically relevant, recommended by DCCT (1993) is a decrease of ≥ 0.50% of HbA_{1C} (Cook & Sackett, 1995).

Blood pressure control is also a significant part of diabetes management. Long term prospective studies showed that improved control of blood pressure could reduce either the macrovascular or microvascular endpoint by 37% (UKPDS, 1998). The Hypertension Optimal Treatment study randomized patients with hypertension who did not have diabetes and those who had diabetes with diastolic pressure of 80,

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85, and 90 mmHg, respectively. The research results showed that the people who did not have diabetes had a similar rate of cardiovascular risks at three levels of these pressures, but 51% of people with diabetes had reduction in CVD risks events, including myocardial infarction and cardiovascular death, at 80 mmHg compared with 90 mmHg. Furthermore, people who had diastolic blood pressure of 80 mmHg also did significantly better than patients with 85 mmHg (Hansson et al., 1998). Therefore, small improvements in blood pressure can yield a big improvement in reducing cardiovascular risks in people with diabetes. These findings led to a lower recommended blood pressure level (130/80 mmHg) in patients with diabetes (ADA, 2004; Gavin et al., 2004). In addition, lowering blood pressure can reduce the frequency of microvascular complications such as blindness, amputation, end-stage renal disease and macrovascular complications (Gavin et al., 2003). The UKPDS reported that tight blood pressure control (144/82 mmHg) compared with an average blood pressure (154/87 mmHg) reduced the relative risk for any diabetes-related end point by 24% ($p < .01$), diabetes-related deaths by 32% ($p < .05$), heart failure by 56% ($p < .01$), retinopathy progression by 34% ($p < .01$), and deterioration of vision by 47% ($p < .01$) after nine year (UKPDS, 1998).

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Lipid control: People with diabetes commonly have elevated triglyceride levels, reduced HDL levels, and elevated LDL levels (ADA, 2003). The National Cholesterol Education Program recommends that people with type 2 diabetes can reduce the risk of stroke, coronary artery disease, and cardiovascular mortality by rigorous lipid reduction therapy (lower LDL cholesterol level below 100 mg/dl) (Goldberg et al.,1998). In addition, the foundation of any treatment should be appropriate lifestyle changes including regular exercise or moderate physical activity and a diet designed to reduce sodium intake, alter lipid patterns, lower blood glucose levels, and induce weight loss (Gavin et al., 2003). Research findings reported that a multiple intervention approaches to reduce glycemia and to treat all cardiovascular risk factors reduced incidence of microvascular and macrovascular complications by approximately 50% in type 2 diabetic patients (Gaede et al., 2003). The modification of nutrient intake and physical activity are appropriate factors to attain and maintain metabolic outcomes (blood glucose and HbA_{1c} level, total cholesterol, LDL cholesterol, HDL cholesterol, triglyceride levels, blood pressure, and body mass index), prevent and treat the chronic complications and comorbid diabetes (ADA, 2003).

Therefore, proactive diabetes management should include patient-center goals for controlling hypertension, lipid levels, and glycemia (Gavin et al., 2003). The goals for reducing cardiovascular events of people with diabetes recommended by ADA (2003) are: HbA_{1c} < 7%, preprandial plasma glucose 90-130 mg/dl (5.0-7.2 mmol/l), peak postprandial plasma glucose < 180 mg/dl (< 10.0 mmol/l), blood pressure < 130/80 mmHg, LDL cholesterol < 100 mg/dl (< 2.6 mmol/l), Triglycerides < 150 mg/dl (< 1.7mol/l), HDL cholesterol > 40 mg/dl (> 1.1mg/dl). To obtain optimal goals requires regular physical activity and a diet designed to reduce carbohydrate intake, sodium intake, alter lipid patterns, lower blood glucose levels, and induce weight reduction. Medical therapy and management is also important when altered diet and exercise is inadequate (Gavin et al., 2003).

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Behavioral control

The essential care for diabetic control encompasses many strategies for behavioral control including dietary management, medication administration management, exercise and physical activity, acute and chronic complications management especially for hypoglycemia and hyperglycemia, in particular hygiene and foot care, and stress management.

Dietary management is the major part of diabetes management. There is no specific dietary diet. Meal plans or meal pattern seem to be preferable term to use in dietary management. Meal planning recommendations should be as flexible as possible (Friesen, 1997). A general admonition to strictly stay away from sugar is inadequate and might lead to a false sense of comfortable and security. Dietary education should consist of a combination of basic nutrition and a goal-oriented treatment plans. People with diabetes should have a diet that supplies all the necessary calories and nutrients for their activities. The keys to achieving effective dietary control consist of an understanding of the nutrient composition of food and diabetes management (Friesen, 1997).

The American Diabetes Association (1995) recommended that the specific goals of diabetes management include: 1) maintaining near normal blood glucose level by balancing food intake with diabetic medication and exercise or physical activities levels, 2) control optimal serum lipid levels including total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides (TG), 3) provide adequate calories for maintaining or attaining reasonable weight for people with diabetes, and 4) decrease nutrition related to risk factors and complications such as obesity, dyslipidemia, and hypertension.

Meal planning for people with diabetes requires health care providers to assess and collaborate to set goals, promote implementation, and evaluate their plan in respect of the individual's lifestyle, ethnic and cultural food issues, financial

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considerations, values, and beliefs. Meal planning and goal setting depend on assessment of dietary history and individual's knowledge, skills, behaviors, and specific needs. The goals established should help people to make positive changes that will result in improvements in blood glucose levels, lipid levels, blood pressure levels, and nutrient goals.

Diabetic meal planning should be based on exchange lists and the health professional should have guideline for nutrition counseling. People with diabetes need to understand that they can decide daily food intake for maintaining and attaining ideal weight, and controlling calories. People with diabetes need a percentage of calories from carbohydrate based on their eating habits, glucose and lipid levels. Carbohydrates recommended are complex carbohydrates or starches that are digested and absorbed much more slowly than simple sugars (Friesen, 1997). Fiber and starch are preferable to highly refined carbohydrates. The amount of fiber recommended for daily consumption is 20-35 grams. Soluble fiber has been shown to lower total cholesterol and low-density lipoprotein that is important for delaying or decrease cardiovascular risks (Vinik & Jenkins, 1998). The amount of recommended protein is based on the body weight. The recommendation is 0.8 gram of protein per kilogram of ideal weight (Friesen, 1997). An increased consumption of protein results in a greater amount of fat when the protein eaten is meat. With an increase in meat consumption, a higher intake of saturated fatty acids will occur. Saturated fats needed include meat, butter fat, bacon, coconut oil, palm oil, and hydrogenated oils and should be less than 10% of total calories. There is no need for additional vitamins or minerals supplementation in diabetic patients. Only people with deficiencies are likely to respond favorably (Friesen, 1997).

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Medication administration plays an important role in diabetes management. Health care providers should be concerned about giving opportunity for patients to understand the hypoglycemic drugs, dosages available per tablet, and expected effects. Patients should have a clear understanding about the medication used which will lead them to detect signs and symptoms of side effects and low blood glucose levels and recognize that oral medication cannot replace dietary management. Taking medication will be effective when accompanied with meal planning.

Exercise and physical activity also play a crucial role in diabetes management by utilizing glucose and delaying or stopping damage to large blood vessels, with decreasing cardiovascular risks. With exercise, energy consumption by the muscle will increase immediately in order to provide the high-energy adenosine triphosphate (ATP) for muscle movement or contraction. The stored glycogen will be used primarily, and then the circulating glucose supplied by the liver will be used for maintaining blood glucose levels at a constant concentration during exercise. Fats are broken down into free fatty acids, bound to albumin and transported in the blood to active muscles. In addition, exercise and physical activities also increase insulin sensitivity. Insulin sensitivity usually continues as long as exercise continues, but decreases rapidly when exercise is stopped (Wallberg-Henriksson, 1992). Furthermore, exercise results in reducing resting blood pressure, increasing serum HDL cholesterol and decreasing serum triglyceride, body fat, and insulin needs. When encouraging exercise in people with diabetes, health care professionals should be concerned about a safer modality of exercise, frequency, duration, intensity, progress, and appropriate exercise for the individual.

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Psychosocial considerations also have an important role in diabetes management. Patients and their families need to make adjustments for living with diabetes. A powerful way to do this is by helping patients and families to share information about diabetes. Stressors will have effects on blood glucose control. People with diabetes are challenged by struggling to eliminate their stressors and cope with their illness. Good stress reduction skills can help these people to minimize impacts of disease and assist in maintaining blood glucose control. Stress management education and training becomes an effective method in assisting people as a whole to be balanced and provide a sense of wholeness in spite of diabetes' powerful effects (Guthrie & Guthrie, 1997).

Monitoring of signs and symptoms is necessary for people with diabetes. During the process of treatment, patients need to be carefully observed for complications. The most common complications in diabetic patients are hypoglycemia and hypoglycemia. In addition, other complications including retinal problems, diabetic neuropathy, paresthesia, or pain in the lower extremities, and postural hypothesion should be monitored. The preceding described diagnostic emergencies and each should be treated promptly. Encouraging people to clearly understand their illness and complications is important in encouraging them to appropriately manage their symptoms.

The successful management of diabetes requires lifestyle changes. People with diabetes must be involved in the decision process and learn how to live with diabetes; therefore, perceived self- efficacy in being able to produce desired goals is a significant factor in promoting self-management behaviors for people with type 2 diabetes.

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Self-Efficacy Theory and Diabetes Self- Management Concept

The self-efficacy theory acknowledges the diversity of human capabilities. It treats the efficacy belief system as a differentiated set of self-beliefs linked to distinct realms of functioning across major systems of expression within activity domains (Bandura, 1997). Self-efficacy is a general capability in which cognitive, social, emotional, and behavioral subskills must be organized to serve one's purposes. Perceived self-efficacy concern a human's belief about what they can do within a variety of circumstances. It is also an important contributor to performance accomplishments under one's skills abilities (Bandura, 1997).

The National Chronic Care Consortium (1999) defined self-efficacy as a function of an individual's attitudes, beliefs, characteristic, and innate abilities, as well as education, knowledge, training, and learning skills. Clark and Dodge (1999) described self-efficacy as a part of a reciprocal process so that a person feels confident in his or her ability to carry out the behavior and the desired out come. Thus, one's confidence comes from the interaction of personal, behavioral, and environmental factors. Self-efficacy can be conceptualized as an individual's perceived judgment of their capabilities to perform a task of a specific domain of performance (Bandura, 1997). It is important that individuals make the decision to participate in a diabetes self-management program if they believe that they are capable of performing the behavior required for the outcome (Lu et al, 2004).

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Bandura (1986, 1997) divided self-efficacy in to two components. The first, self-efficacy expectation is one's judgments about his or her individual ability to achieve a task. This component is important for an individual's decision to participate in a specific behavior when they believe in their capabilities. The second, outcome expectation, is defined as a persons' estimation that a given behavior will lead to certain outcomes (Bandura, 1997). Outcome expectations are based on the individual's self-efficacy expectations. Either self-efficacy expectation or outcome expectation are significant factors to predict health behaviors (Stanley & Maddux, 1986). Efficacy beliefs vary on several dimensions, including level, generality, and strength. Firstly, efficacy beliefs differ in different people. If the specific activity is easy to perform and there is no obstacle against performance, the person will have high perceived self-efficacy. Secondly, efficacy beliefs also differ in generality, including the degree of similarity of activities, the modality of capabilities (behavioral, cognitive, and affective), qualitative features of situations, and the characteristics of the person. Finally, efficacy beliefs vary in strength. People who have a strong belief in their capabilities will persevere in their efforts even if they meet innumerable difficulties and obstacles. The stronger the sense of personal efficacy, the greater the perseverance, and the higher the likelihood that the chosen activity will be performed successfully. Furthermore, concern about results from actions, and belief in their capabilities encourages people to perform deliberate actions (Bandura, 1997).

Increased self-efficacy is associated with increased adherence to treatment, increased self-care behaviors and decreased physical and psychological symptoms (Resnick, 2003). Therefore, self-efficacy is a significant factor in promoting behavior change and the ability to carry out a behavior modification necessary to reach a desired goal. The stronger the sense of efficacy a person has, the higher the accomplishment of the person (Bandura, 1994).

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Existing data illustrates that self-efficacy plays a crucial role in promoting patients' ability to self-manage their diabetes. Self-efficacy is related to the willingness and the ability of people to engage in various situation-specific self-management tasks (Anderson, Fitzgerald, Funnell, & Marrero, 2000). A higher self-efficacy for diabetes management has been found to be associated with the perception of lower barriers to diabetes regimen adherence and lower HbA_{1c} (Howells, 2002). Therefore, interventions designed to promote self-management in people with diabetes must be structured in ways that builds the efficacy beliefs needed to support the behaviors (Bandura, 1997).

Self-management is now widely recognized as a necessary method for maintaining and improving patients' health behavior and health status (Dongbo et al., 2003). It is an essential nursing approach, especially in people with chronic conditions. Self-management includes careful monitoring and ongoing medical care by the healthcare providers, and knowledgeable self-care by people with diabetes.

Self-management in chronic disease conditions has been defined as learning and practicing the skills necessary to carry on an active and emotionally satisfying life (Lorig, 1993). Self-management implies monitoring and managing symptoms, adhering to treatment regimens, keeping a healthy lifestyle, and managing the impact of the illness on daily functioning, emotions, and social relationship in chronic illness (Schreurs, Colland, Kuijer, Ridder, & Elderen, 2003).

Self-management involves processes including: goal selection; information collection; information processing and evaluation; decision making; action; and self-reaction (Creer, 2000). Goal selection is the activity that is collaborated between patients and health care professionals after discussions, negotiations, and determination.

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It is the responsibility of people to perform whatever self-management skills are necessary to attain the goal (Creer & Holroyd, 1997). Information collection is based on self-monitoring, or self-observation, and self-recording of data. It is an important condition to determine if goals are achieved. Information collection is composed of monitoring target behaviors with an objective measure, and observing or recording information during a specific time period (Creer, 2000; Creer & Bender, 1993). During information processing and evaluation, people detect any specific health changes, evaluate data they have collected about their conditions, make adjustment to health behavior based on data, learn to evaluate the antecedent conditions that have led to the change, and consider contextual factors (Creer & Bender, 1993, Creer & Holroyd, 1997). Decision-making is the accurate and complex judgments of individuals after collecting, processing, and evaluating data on their illness (Creer & Holroyd, 1997). Action is defined as self-instructional skills to control a health-related condition such as planning, problem solving, verbal self-cueing, and self-reinforcement (Creer, 2000; Creer & Bander 1993; Karoly, 1993). Finally, self-reaction refers to how individuals evaluate their performance (Bandura, 1986). It is a necessary ingredient in the performance of self-management skills and also important to sustain these skills over time (Creer, 2000). The specific content of self-management interventions vary considerably depending on the problems that must be managed (Tobin, Reynolds, Holroyd, & Creer, 1986).

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Self-management is an accurate assessment of one's own knowledge, skills and abilities; well defined and realistic personal goals, monitoring progress toward goal attainment and being motivated through goal achievement, exhibiting self-control and responding to feed back (Browder & Shapiro, 1985). It is interpreted as the day-to-day tasks an individual must undertake to: 1) control or reduce the impact of disease on physical health status; 2) cope with the psychosocial problems generated by chronic disease; and 3) manage daily living according to their financial and social conditions (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). Self-management enables a person to make informed choices; to adapt new perspectives and generic skills that can be applied to new problems as they arise; to practice new health behaviors; and to maintain or regain emotional stability (Lorig & Holman, 1993). Gruman and von Korff (1996) defined self-management based on a comprehensive literature review as engaging in activities that protect and promote health, monitoring and managing systems and signs of illness, managing the impact of illness on functioning, emotions and interpersonal relationships and adhering to treatment regimes.

Diabetes self-management is defined as a set of skilled behaviors used to manage one's own illness (Ruggiero et al., 1997). It is demanding and requires much effort, discipline, skill, and knowledge to reach optimal glycemic control. Management of diabetes requires demanding behavioral modification, commonly including dietary management; exercise or moderate physical activities, medication, stress management, and blood glucose testing as the key components of care. Patients with diabetes are expected to conduct their own diabetes management and to make multiple life style changes. Diabetes self-management to achieve optimal control requires patients with diabetes to understand the effect of exercise, medication taking, dietary intake, and stress on blood glucose levels; to understand the complex physiological changes; and to incorporate the changes into self-management decisions (Sullivan & Joseph, 1998).

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Diabetes self-management has three attributes (Wattana, 2004). The first attribute is realistic personal goal setting. The goals of diabetes self-management are to achieve glycemic control, prevent acute and chronic complications, and optimize quality of life (Barlow et al., 2002; DeWeerdt, Visser, & van der Veen, 1989; Norris et al., 2001). Existing studies reported that when people are unclear about what they are trying to accomplish, their motivation may be low and their efforts may be poorly directed. Goals not only provide guides and motivators of performance, but they also help to build and strengthen a sense of efficacy. The more they succeed in attaining their goals, the higher people's beliefs in their capabilities (Bandura, 1997). Therefore, to motivate diabetes self-management, goal setting must be explicit, and must provide good feedback of performance on a regular basis.

The second attribute, monitoring progress, is an active role that the patients must undertake to control or reduce the impact of disease as they manage daily living. Self-management identified as a procedure that patients use to change aspects of their own behaviors, monitoring and managing symptoms and the impact of illness on daily functioning, and maintaining healthy lifestyle. This change requires monitoring progress guided by: goal selection; information collection; information processing and evaluation; decision making, action, and self-reaction (Creer, 2000).

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The third attribute, diabetes self-management, is making adjustments to attain glycemic control. The self-management process is not static; patients must learn to understand the physiological changes and to incorporate the change into their self-management decisions. The successful management of diabetes with the goal of achieving near-normoglycemic requires patients to make adjustment for lifestyle changes aimed at reducing the risk of complications associated with their illness (Clarke, Crawford, & Nash, 2002).

In conclusion, diabetes self-management, defined by the researcher, is a set of skilled behaviors for controlling one's own illness. It depends on one's knowledge and ability to practice self-behaviors. These behaviors include meal planning, exercise/ physical activity, symptoms monitoring, medication taking, and stress reduction. Diabetes self-management is accomplished through realistic personal goal setting, monitoring progress, and making adjustment for goal attainment.

Diabetes self-management is widely recognized as a necessary process for maintaining and improving patients' health behavior and health status (Dongbo et al., 2003). The use of self-management interventions has advanced considerably in the last three decades (Tobin et al. 1986). The American Diabetes Association and the British Diabetic Association recommended that enabling people with diabetes to self-manage is central to providing high quality standards of diabetes care. Several research findings reported that diabetes self-management is associated with decreased hospitalizations for diabetes-related problems and reduced health care costs (Clement, 1995), positive effects on knowledge and accuracy of self-monitoring of blood glucose, improved self-reported dietary habits, and improved glycemic control (Norris et al., 2001). From 1980-1999, Norris et al., (2001) conducted a systematic review of randomized control trials focusing on the effectiveness of self-management training in type 2 diabetes. Findings showed the effectiveness of self-management training in type 2 diabetes, particularly in the short term; however, strategies to improve behavioral change in the self-management of sustained glycemic control, cardiovascular (CVD) risk factors, and quality of life (QOL) of type 2 diabetic patients still needs further

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assessment (Norris et al., 2001). Although the research shows the effectiveness of self-management interventions, the research of self-management of diabetic Thai people is scarce.

An integrative review was conducted by Wattana (2004) for analyzing what interventions produce physiological outcomes and/or improved QOL for adults with type 2 diabetes by conducting a systematic review, an extension of Norris et al., (2001), from January 2000 to August 2004. This current review was conducted using the databases PubMed, CINAHL, and Diabetes Care from 2000 to August 2004. Inclusion criteria for this review included: (1) intervention studies involving adult patients with type 2 diabetes, (2) randomized control trial, (3) published in English language journals, and (4) published between 2000 and July 2004. Exclusion criteria for this search were: (1) unpublished studies and dissertations and (2) when full texts were unavailable.

Overall, 30 intervention studies were found that met the inclusion criteria on the diabetes self-management for adult type 2 diabetes. Most of interventions, 16 of 30 studies (53.3%), examined outcomes by evaluating glycemic control (HbA_{1c} and/or fasting plasma glucose [FPG]) and CVD risk factors (total cholesterol, HDL-cholesterol, LDL-cholesterol, triglyceride (TG), blood pressure (BP), body mass index (BMI). Seven interventions (23.3%) focused on glycemic control alone, six interventions (20%) focused on glycemic control, CVD risk factors and QOL, and one study (3%) focused only on QOL.

Findings showed that studies which aimed to improve glycemic control and decrease CVD risk factors, used strategies that focused on dietary management, exercise/physical activity, medical adjustment, self-monitoring, stress-management/or

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dealing with emotional aspects of illness, self-care activities, smoking cessations, foot and skin care, signs and symptoms monitoring, and screening/ test appointment. Eleven of the thirty studies (36.67%) used one strategy to promote patient outcomes. Six of the thirty studies used two strategies to improve patient outcomes (20%). Most studies, 13 of the 30 (43.3%) used multiple strategies to improve glycemic control, decrease CVD risk factors and increase QOL. Nine of thirty studies (30%) were conducted for a short duration (< 6 months), eighteen studies (60 %) were conducted for an intermediate duration (6-12 months), and three studies (10 %) were conducted for a long period (> 12 months).

According to the duration of intervention, the eight research studies conducted for a short term (< 6 month) focused on glycemic control and CVD risk factors. Four of the eight studies used two strategies to improve glycemic control and decrease CVD risk factors. One study used one strategy approach, and three studies used multiple strategies approach. Research findings showed the study using one approach (exercise training) had positive effects only on HbA_{1c} and FPG (Maiorana et al., 2002).

Four of the eight studies used two strategies to promote glycemic control and decrease CVD risks in a short period: 1) diet and exercise (Goldhaber-Fiebert, Fiebert, Tristan, & Nathan, 2003); 2) diet and physical activity (Mayer-Davis et al., 2001); 3) diet and self-monitoring of blood glucose (Miller, Edwards, Kissling, & Sanville, 2002); and 4) self-monitoring of blood glucose and nutrition (Kwon et al., 2004). Research findings showed all of these studies (100%) had significant improvement only on HbA_{1c}.

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Three of the eight studies (37.5%) used multiple strategies to promote glycemic control (Castaneda et al., 2002; Kim, & Oh, 2002; Oh, Kim, Yoon, & Choi, 2003). The research findings showed strongly significant improvement of HbA_{1c} in all three studies (100%). The improvement of HbA_{1c} in the short term studies showed a more effective outcome when using multiple strategies and a two strategy approach more effective than a one strategy approach. However, research findings reported that interventions using one strategy, two strategies, and multiple strategies still did not produce improvement of CVD risk outcomes.

Eighteen of 30 interventions (60%) were conducted in an intermediate period (6-12 months). Eight of these studies (44.4%) used one strategy to promote glycemic control and decrease CVD risk factors. Three of the eighteen studies (16.7%) used two strategies, and seven of the eighteen studies (38.9%) used multiple strategies to conduct the study. Research findings indicated that studies using a one strategy approach demonstrated significant improvement of glycemic control (Alam et al., 2004; Glasgow, Toobert, Hampson, & Strycker, 2002; Guerci et al., 2003; Kirk et al., 2001; Varround-Vial et al., 2004). Six studies used one strategy to promote both glycemic control and CVD risk factors. Research findings showed four studies: 1) dietary intervention (Glasgow et al., 2002); 2) exercise training (Alam et al., 2004); 3) exercise consultation (Kirk et al., 2003); and 4) self-monitoring of blood glucose (Guerci et al., 2003) had positive improvement in some of CVD risk factors.

Three studies used a two strategy approach by focusing on glycemic control and CVD risk factors. Research findings showed one study (self-monitoring of blood glucose) had significant improvement only of HbA_{1c} level (Schwedes et al., 2002).

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Seven studies used multiple strategies to promote patient outcomes. Two of the seven studies (28.6%) measured the effects of intervention only on HbA_{1c} (Goundwaard et al., 2004; Williams, McGregor, & Zeldman, 2004). Three of the seven studies measured the effects of intervention on HbA_{1c} and CVD risk factors (Brown, Kouzekanani, Garcia, & Hanis, 2002; Glasgow et al., 2002; Polonsky et al., 2003). Three of the seven studies focused on HbA_{1c}, CVD risk factors, and QOL (Taylor et al., 2003; Toobert et al., 2003; Wolf et al., 2004).

Findings showed six studies had positive effects on HbA_{1c} (Brown et al., 2002; Goudwaard et al., 2004; Polonsky et al., 2003; Taylor et al., 2003; Toobert et al., 2003; Wolf et al., 2004). Four of five studies (80%) showed positive effects on some of CVD risk factors: total cholesterol and LDL (Taylor et al., 2003); BMI (Toobert et al., 2003); and body weight (Goudwaard et al., 2004; Wolf et al., 2004). Interventions, with follow-up in an intermediate period, showed more effective outcomes on HbA_{1c} and CVD risk factors when using multiple strategies rather than using one or two strategies. However, improvements in CVD risk factors in intermediate period studies still were not consistent. Compared with interventions conducted in the short term, interventions with an intermediate time period seemed to show smaller positive outcomes on glycemic control than interventions conducted in the short term. However, interventions with intermediate follow up showed greater significant improvement in decreasing some CVD risk factors than interventions in the short term.

Only three of the 30 studies (10%) were conducted over a long term period (> 12 months). All of these studies promoted patient outcomes by a using multiple strategies approach. One study measured the effect of intervention by focusing on

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HbA_1c (Sarkadi & Rosenqvi, 2004). Two studies focused on HbA_{1c} and CVD risk factors (Krein et al., 2004; Sone et al., 2002). Research findings showed two out of three studies (66.7%) had positive improvement in HbA_{1c} (Sarkadi & Rosenqvi, 2004; Sone et al., 2002). Studies demonstrating improvements in decreasing both HbA_{1c} and CVD factors were not found. Compared with short-term and intermediate interventions, studies conducted for a long period showed inconsistent improvements in glycemic control.

The short-term studies that used multiple strategies produced more strongly positive effects on HbA_{1c} than the intermediate and long-term studies. It seemed the effects of interventions in the short-term period, intermediate and long-term using one strategy, combined strategies and multiple strategies still were inconsistent in improving CVD risk factors. However, interventions with intermediate follow up had greater significance in decreasing CVD risk factors than interventions with a short-term and long-term period. Therefore, the study of diabetes self-management for decreasing CVD risk factors in an intermediate period is still needs repetition. Although the physiological outcomes from diabetes self-management intervention are important for the health of individuals, quality of life is also essential to consider for people with type 2 diabetes.

Quality of life (QOL) is a complex and multidimensional aspect that includes all areas of life. It is defined as the state of well being that composes of either the ability to perform daily activities that reflect physical, psychological, and social well-being, or patient's satisfaction with levels of functioning and control of disease (Lubkin & Larsen, 1998). The World Health Organization of Life Group (1998) defined QOL as the individuals perception about their life position in the

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context of the culture and value systems related to goal expectations, standard and concerns. QOL domains were defined in different aspects including life satisfaction, self-concept, health and functioning, and socioeconomic factors (Zhan, 1992), physical health, psychological state, levels of independence, social relationship, environmental factors, and spiritual concerns (King & Hinds, 1998). In conclusion, QOL is the individual's perceptions of their health and functional status, and factors related to their health.

From integrative reviews, seven of thirty studies (23.3%) examined QOL. Only one study used one strategy (exercise consultation) to promote QOL in a short period of time (Kirk et al., 2001). The research findings of this study showed a significantly increased QOL (Kirk, 2001). In the intermediate period, six studies measured the effects of interventions on QOL, glycemic control and CVD risks. Three of these studies used one strategy approach to promote QOL (Glasgow et al., 2002; Glasgow & Toobert 2000; Varround-Vial et al., 2004). Findings showed two of the three studies (66.7%) produced positive effects on QOL (Glasgow et al., 2000; Glasgow et al., 2003). Three studies used multiple strategies to promote QOL in an intermediate period (Taylor et al., 2003; Toobert et al., 2003; Wolf et al., 2004). Findings showed two of the three studies demonstrated significant improvement in QOL (Toobert et al., 2003; Wolf et al., 2004). In this review, studies within a long period of time do not examine effects of interventions on QOL. Compared with the short term period interventions, research findings do not show greater effects of studies with an intermediate period on QOL than studies undertaken over a short term.

There is a rare study about QOL in adult with type 2 diabetes in Thailand. Puavilai (1996) studied the life quality and life experiences of 57 Thai adult women

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with diabetes who attended the out-patient department of government hospitals. Research results showed that Thai women with diabetes perceived moderate satisfaction with their lives. Three major concerns of life satisfactions included family concerns-such as lack of support from family members, financial problems, and the impact of diabetes on their lives. Patients with a low level of life satisfaction with diabetes (16%) perceived a higher impact of diabetes on their lives, and received less family support than patients with medium or high levels of life satisfaction. Life experiences relevant to life quality of Thai women with diabetes included perception of illness, adaptive tasks, and coping skills. Research findings reported that these patients perceived diabetes as a serious disease that had impacts on their lives. The major problem was patients lack of knowledge of diabetes.

Instrument used in the studies that measured QOL were as follows; three studies used SF-36 (Kirk et al., 2001; Taylor et al., 2003; Wolf et al., 2004). Two of these studies showed positive outcomes on QOL using SF-36 (Kirk et al., 2001; Wolf et al., 2004). Two studies measured QOL with the Quality of Life Illness Intrusive Scale. The researchers who used this instrument identified a face validity of 13-items of 13 life domains and the reliability was 0.66 (Glasgow & Toobert, 2000). One of two studies showed positive effects of QOL when measured with Quality of Life Illness Intrusive Scale (Glasgow & Toobert, 2000). One study measured QOL by using the Problem Areas in Diabetes (PAID) scale that was a diabetes specific measure of QOL (32-item, produced subscales on four dimensions)(Toobert et al., 2003). This study reported that the PAID scale had a good construct and criterion validity that showed responsiveness to psychosocial interventions. The research findings showed a positive effect on QOL when measured with PAID scale. One study

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did not mention what instrument was used to measure QOL (Varround-Vial et al., 2004). The SF-36 was used more often to measure QOL for adults with type 2 diabetes.

From research findings, it can be concluded that diabetes self-management has a crucial role in promoting glycemic control, decreasing some CVD risk factors, and improving QOL for adults with type 2 diabetes, particularly, yielding a positive effect on glycemic control in the short-term period. Interventions using multiple strategies seem to promote higher positive effect on HbA_{1c} compared with interventions using one or two strategies and seem to have more positive effects on producing improvement in CVD risk outcomes than interventions in of other lengths. Only a few studies examined the effects of self-management intervention on QOL. Therefore, further research should be conducted to replicate and expand on the results. Diabetes self-management interventions need multiple strategies to promote the effectiveness of programs. In addition, intensive interventions should be offered with reinforcement to promote adults with type 2 diabetes to sustain glycemic control, reduce CVD risk factors, and ultimately improve ultimate QOL, especially in an intermediate period.

In Thailand, a meta-analysis of findings from educative - supportive interventions for people with type 2 diabetes was conducted from 1977-1999 (Likitratcharoen, 2000). Research results showed 57 studies were summarized, 45 theses from graduate students, and 12 studies from clinical research. The research settings were mainly Out-Patient Departments in urban hospitals. Most of studies were developed based on Orem's nursing theory. The time for following was normally eight weeks with three encounters in this period. The outcome measures were mainly self-care ability (78.95%), metabolic control (68.42%), patient knowledge (49.2%), and

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patient's belief and attitude toward illness (24.56%). Although many quasi-experimental studies showed statistically significant reduction in fasting plasma glucose after entering the program, nearly a half of the people with diabetes still could not control their diseases (Hanucharurnkul, 2002). Additional studies related to type 2 diabetic patients have been published since 2000 for type 2 diabetic patients. Most used a quasi-experimental design and were conducted in a short term period (< 6 months). Four studies focused on blood glucose control (Praingam, 2002; Sripanyawutisak, 2003). Findings reported that the exercise program Oigong contributed to significantly decreasing the HbA_{1c} level (Prongpanom, 2002). Group processes and social support showed an improvement in blood glucose levels (Praingam, 2002), but self-help group intervention showed a non significant improvement in glycemic control (Sripanyawutisak, 2003). One study was conducted using health education based on self-efficacy and social support with a focus on behavior modification. Findings showed a significant increase of knowledge about diabetes mellitus, self-efficacy, outcome expectations, and behaviors regarding dietary control, physical exercise, and compliance with the medical regimen, but foot care behaviors were not improved (Waeladee, 2001). Two studies were conducted focusing on knowledge and self-care behaviors (Chitwarin, 2001; Praingam, 2002). Group process and social support intervention was conducted and research findings showed an improvement of knowledge, and self-care behaviors (Praingam, 2002). One study reported that discharge plans for people with type 2 diabetes could improve perceived self-care but perceived self-care agency and value of discharge planning by professional nurses were not significantly different (Sriprawong, 2000). One study was conducted focusing on knowledge, self-care activities, QOL and glycosylated hemoglobin based on Orem's self-care

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theory and cognitive behavioral therapy for people with type 2 diabetes. Results indicated that the experimental group had higher mean scores of knowledge, self-care activities, and QOL than the control group at three and six months but the difference of glycosylated hemoglobin was not statistically significant (Keeratiyutawong, 2005).

In conclusion, most interventions for Thai people with type 2 diabetes were didactic health education programs that were conducted in a short time period (≤ 4 months). Findings from these interventions were inconsistent in improving glycemic control. There is a rare study to assess diabetes self-management intervention with multiple strategies on glycemic control. Additionally, interventions to reduce CVD risk were not found. Therefore, the researcher plans to conduct an intensive diabetes self-management intervention based on the self-efficacy theory and self-management. This intermediate period program intends to promote diabetes education and skills for behavior change using multiple strategies and combined with the reinforcement of education over time to promote knowledge of diabetes, improve glycemic control, reduce CVD risk and improve QOL for people with type 2 diabetes.

Theoretical Framework

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Self-efficacy (SE), derived from Bandura's Social Cognitive Theory (Bandura, 1977), and self-management (Creer, 2000) were used as a model to guide this study. Self-efficacy is conceptualized as an individual's perception, or judgment of one's capabilities to organize and execute courses of action required to attain a specific health behavior. Self-efficacy has two components: self-efficacy expectations; and outcome expectations (Bandura, 1977, 1986). Self-efficacy expectations are one's judgments about individual's ability to achieve a given task. Outcome expectations are what will happen if a given task is successfully achieved based on the individual's self-efficacy expectations or self-efficacy judgments. Expectations about one's self-efficacy can be enhanced through; the actual performance of a behavior; vicarious experience; verbal persuasion; and physiological feedback during those behaviors. Cognitive appraisal of these factors results in a perception of the level of confidence in the individual's capability to perform a certain behavior. Expectations of self-efficacy in a diabetes self-management regimen determine what behaviors will be initiated and maintained when faced with barriers to self-management (Melkus et al., 2004).

Self-efficacy is an important factor for individuals when they decide whether or not to participate in activities. Bandura (1977) stated that people do not always choose appropriate behaviors. The choice is not because they lack the knowledge or ability to perform other behaviors, but, rather they are concerned about the result from their actions. Therefore, to promote diabetes self-management behaviors for better glycemic control, decrease CVD risks and enhance QOL, knowledge alone is not enough to guarantee that appropriate behaviors and beliefs will change specific behaviors. Self-efficacy beliefs are strong determinants and predictors of the level of accomplishment that individuals finally attain.

Existing data illustrates that self-efficacy beliefs plays a crucial role in patients' ability to self-manage their diabetes. Self-efficacy is related to the willingness and ability of people to engage in various situation-specific self-management tasks (Anderson, Fitzgerald, Funnell, & Marrero, 2000). To increase self-efficacy in people with diabetes, strategies to promote perception of the level of confidence in an individual's capability to perform diabetes self-management behaviors will be provided. These strategies include: putting individuals into a specific situation where one can

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practice the actual performance of the diabetes self-management behaviors, promoting vicarious experiences by using a role model, verbal persuasion to take actions and monitoring progress, and promote self-evaluation in physiological feedback and reinforcement during behaviors change.

Self-management has been defined as learning and practicing the skills necessary for a person to carry on an active role in managing health conditions (Creer, 2000; Lorig, 1993; Lorig & Holman, 1993). Processes significant in the self-management of chronic illness include: goal selection; information collection; information processing and evaluation; decision making; action; and self-reaction (Creer, 2000). The specific content of self-management interventions vary considerably depending on the problems that must be managed (Tobin et al., 1986).

As mentioned previously, diabetes self-management is defined by the researcher as a set of behaviors for controlling one's own illness. It is dependent on one's knowledge and the ability to practice self-behaviors. These behaviors include meal planning, physical activity, symptoms monitoring, proper taking of medication, management of acute and chronic complications, and stress reduction. Diabetes self-management is accomplished through realistic personal goal setting, action to control illness, monitoring progress, and making adjustments to attain goals (Wattana, 2004). The theoretical model combining concepts from self-efficacy and diabetes self-management models guided this study. Enhancement of self-efficacy and self-management skills must be taught to the people with diabetes, which allows better control over personal health maintenance and daily living challenges. Coping with the challenges of type 2 diabetes requires not only knowledge and skills but also a

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belief in one's ability to use the skills in real situations encountered by the individual and a belief that the use of skills will produce positive, desired outcomes.

The diabetes self-management program in this study was planned to provide specific approaches for promoting self-efficacy in self-management behaviors that include self-efficacy in: realistic personal goal setting, actions to control illness, monitoring progress, and making adjustment to goal attainment. People with type 2 diabetes who participated in this program received diabetes education and skills training that increased their self-efficacy in diabetes self-management behaviors, thereby increasing self-management behaviors (goal setting, behaviors to control illness, symptoms monitoring, and decision making behaviors) and resulting in increased knowledge, improved glycemic control, decreased CVD risk, and increased quality of life (see *Figure 1*).

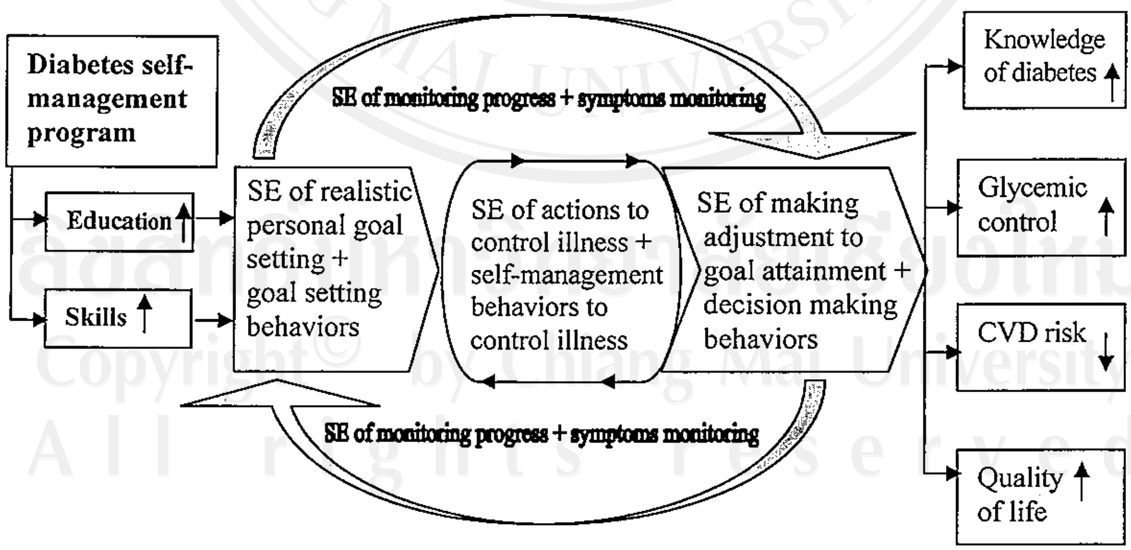

Figure 1. The conceptual model of the study

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