CHAPTER 2

Literature Review

This chapter reviews the literature related to diabetes mellitus, glycemic control among adults with T2DM, glycemic control behavior among adults with T2DM, sociocultural factors influencing glycemic control behaviors among adults with T2DM and glycemic control behaviors among adults with T2DM in the Sri Lankan context. The chapter concludes with describing naturalistic inquiry as the philosophical underpinning and ethnographic approach as the research methodology used in this study.

Diabetes Mellitus

Definition and Pathophysiology of Diabetes

In the 6th century BC, Indian physician Sushruta was named as the first who describe about type 2 diabetes (Dwivedi & Dwivedi, 2007). Later in the second century, the term 'diabetes' was first used by Aretaeus of Cappadocia AD as a generic description for symptoms of increased urine output (Herman, Kinmonth, Wareham, & Williams, 2010). According to the ADA (2012), DM is a chronic metabolic disorder resulting from a deficiency of insulin secretion, insulin action or both. Insulin is produced by the β–cells of the islets of Langerhans in the pancreas. Lack of insulin secretion, impaired insulin secretion and insulin action (insulin resistance) cause the impaired metabolism of carbohydrate and other energy-yielding fuels (Williams &

Pickup, 2004) which lead to the increase the levels of plasma/blood glucose (hyperglycemia) resulting in DM. Chronic hyperglycemia of DM can lead to long-term dysfunction, damage, or failure of various tissue and organs such as eyes, kidneys, heart, vascular tissue and nerves (Hawthorne et al., 2008).

Many organizations and scientists categorize DM based on the primary mode of onset and pathology of the disease process. According to one of the most recognized associations for standard diabetes management, the American Diabetes Association (ADA, 2012) classified DM into four clinical types as follows:

Type 1 Diabetes mellitus (T1DM). T1DM formally named as insulin dependent diabetes mellitus (IDDM) or juvenile/younger onset diabetes. T1DM is more common in early stage of life but could occur at any stage of life. T1DM comprises approximately 5%-10% of cases in diabetes (Williams & Pickup, 2004). It is caused by destruction (autoimmune or idiopathic) of the insulin production β –cells of the islets of Langerhans in the pancreas, resulting in absolute insulin deficiency (ADA, 2012). However, the exact causes are complex and still imperfectly understood. People with T1DM usually need insulin treatment as they can no longer produces it within their bodies (ADA, 2012). Most common clinical symptoms of T1DM are polyuria, polydipsia, polyphagia and weight loss (Williams & Pickup, 2004).

Type 2 Diabetes mellitus (T2DM). T2DM is formally named as non-insulin dependent diabetes mellitus (NIDDM). This is the most common type of diabetes, representing about 85% of the disease. It is caused by both impaired and resistance to the action of insulin at its target cells (ADA, 2012). Obesity and reduced physical activity are major risk factors followed by increasing age and family history

of diabetes for developing T2DM (ADA, 2012). The greatest risk of T2DM is associated with central or truncal obesity, where fat is deposited subcutaneously and at intra-abdominal sites and this fat liberates large amount of non-esterified fatty acids through lipolysis which increase the gluconeogenesis and inhibit insulin secretion (Williams & Pickup, 2004). As a result, prevalence of T2DM is high in obese people.

Gestational diabetes mellitus (GDM). GDM is defined as any degree of glucose intolerance with onset or first identification during pregnancy (ADA, 2012). It occurs in approximately 3% - 5% of all pregnancies. GDM usually appears in the 2nd or 3rd trimester, because the pregnancy associates of insulin antagonistic hormones reach their peak levels during these trimesters (Williams & Pickup, 2004). Further, five to ten years later, T2DM can develop in women who had GDM (ADA, 2012).

Diabetes due to other specific causes. This type of DM occurs due to genetic defects in β-cell function, genetic defect in insulin action, disease of the pancreas and drug or chemical–induced (ADA, 2012). This type comprises about 1%-2% of cases in DM.

Diagnostic Criteria for DM

The diagnostic criteria for DM are based on the hyperglycemic and ADA (2012) diagnostic criteria for DM are as follows:

1. Fasting plasma glucose (FPG) levels ≥ 126 mg/dl (7.0mmol/l). Results should be confirmed by repeat testing in the absence of unequivocal hyperglycemia (fasting is defined as no caloric intake for at least 8 hours); OR

2. Two hours plasma glucose ≥ 200 mg/dl (11.1mmol/l) during an oral glucose tolerance test (OGTT). The test should be performed as described by the World Health Organization [WHO], using a glucose load containing the equivalent of 75g anhydrous glucose dissolved in water. Results should be confirmed by repeating testing in the absence of unequivocal hyperglycemia. If FPG levels are less than 126mg/dl and there is a high index of suspicion exits for T2DM based on risk factors, OGTT should be done on another day; OR

3. A patient presents with classic symptoms of hyperglycemic crisis, and a random plasma glucose / (Random Blood Sugar/RBS) ≥ 200 mg/dl (11.1mmol/l); OR

4. HbA1c ≥ 6.5%. The test should be performed in a laboratory using a method that is standardized to the DCTT assay. Results should be confirmed by repeating testing in the absence of unequivocal hyperglycemia.

Further, screening for T2DM should be performed by a health care provider at 3 year intervals beginning at the age of 45 years, particularly in patients with major risk factors according to the ADA guidelines (ADA, 2012).

Complications of DM

One of the most important clinical features of all forms of DM is its association with serious acute and chronic complications. Persistent levels of high blood glucose levels can damage to both large and small blood vessels with resulting eye, kidney nerve, heart and circulatory complications (Hawthorne et al., 2008).

Acute complications. Hyperglycemia and hypoglycemia are the most common acute complications of DM (ADA, 2012). In hyperglycemia high blood glucose occurs due to the body having very low little insulin or when the body cannot

use insulin properly (ADA, 2012). Hyperlgycemia can be further classified into diabetic ketoacidosis (DKA) and the hyperosmoler hyperglycemic state (HHS). DKA and HHS have a common precipitating factor, infection, which is the most common, and others including discontinuation or inadequate insulin therapy, pancreatitis, myocardial infarction, cerebrovascular accident and drugs (Kitabchi et al., 2009). DKA is a state for severe uncontrolled diabetes caused by insulin deficiency and requires immediate treatment with insulin and intravenous fluids (Williams & Pickup, 2004). Kitabchi et al. (2009) have established that the criteria for diagnosis of DKA as follows: plasma glucose > 250 mg/dl, with arterial pH 7.25 (mild DKA), 7.00 to <7.24 (moderate DKA), and <7.00 (severe DKA); serum bicarbonate 15-18 (mEq/l) (mild DKA),10-15 (mEq/l) (moderate DKA); with positive urine ketone and serum ketone, mental status–alert (mild DKA), alert/drowsy (moderate DKA) and stupor/coma (severe DKA). Treatment for DKA requires correction of dehydration, hyperglycemia, and electrolyte imbalances but identification of comorbid precipitating events and frequent monitoring above all. HHS is relatively uncommon but carries a high mortality of about 15% particularly in the elderly. The most characteristic feature in HHS is severe dehydration with hyperglycemia and treatment includes aggressive rehydration and electrolyte replacement (Kitabchi et al., 2009).

In general, hypoglycemia occurs when the blood glucose level in the body is lower than 70 mg/dl and typical symptoms are sweating, tremulousness, hunger and dizziness (ADA, 2012). These symptoms are relieved by eating or drinking something sweet. Severe hypoglycemia may cause loss of consciousness or another major alteration of mental status which requires an urgent medical assistance.

Furthermore, hypoglycemia is a common side effect of treatment of insulin and some sulphonylurea drugs (Williams & Pickup, 2004).

Chronic complications. Chronic complications of DM can be categorized into macrovascular complications (cardiovascular diseases, peripheral vascular diseases) and microvascular complications (retinopathy, nephropathy, neuropathy and diabetic foot). DM related chronic complications are the major causes of increasing mortality and morbidly associated with DM (ADA, 2012). In terms of macrovascular complications, cardiovascular disease (CVD) is the most common complication and the cause of mortality and morbidity for individuals with DM.

With regard to microvascular complications of DM, retinopathy is the most common cause of blindness among middle adulthood with T2DM around the world (ADA, 2012; Raymond et al., 2009). Diabetic retinopathy refers to progressive pathogenic alteration in the retinal microvasculature leading to areas of retinal non-perfusion, increased vascular permeability, and the pathologic proliferation of retinal vessels (Unger, 2007). Further, a community-based cross-sectional study in United Kingdom with 1,035 European (614 patients) and South Asians (421) T2DM patients revealed that South Asian ethnicity had a greater prevalence of diabetic retinopathy (Raymond et al., 2009). However, the results of the United Kingdom Prospective Diabetes Study (UKPDS) Group trials show that the control of both blood sugar and blood pressure by diet and exercise decrease the risk of developing retinopathy (UKPDS Group, 1998) among subjects withT2DM.

Nephropathy is another diabetes microvascular complication associated with the greatest mortality. In USA, 45% of the 373,000 new cases of end-stage renal disease diagnosed in 2000, resulted from diabetic nephropathy. A majority of them

were patients with T2DM (Lysaght, 2002). Diabetes nephropathy is characterized by proteinuria, hypertension and progressive kidney failure, and can be diagnosed based on the value of micro albumin urea which is defined as a urine albumin excretion rate of 30-299 mg/24 hours in a urine sample (Unger, 2007). Once urinary protein levels increase, the incidence of stroke, amputation, neuropathy and retinopathy is also increased (Yusef et al., 2000). Treatment of known risk factors such as hypertension, dyslipidemia and cessation of smoking are the basis for prevention of diabetic nephropathy (ADA, 2012). Thus controlling blood pressure and lipid levels via dietary modification, increasing physical activity and cessation of smoking are beneficial to reduce nephropathy.

Among diabetic microvascular complications, diabetic neuropathy especially peripheral neuropathy is the most prevalent and bothersome complication among patients with DM. In developed countries diabetic neuropathy accounts for 50% to 75% of non-traumatic amputations (Vinik & Mehrabyan, 2004). Risk factors for developing diabetic neuropathy can be categorized into modifiable risk factors such as obesity, hyperglycemia, smoking, hypertension and HbA1c; and non-modifiable risk factors such as family history, advanced age and duration of diabetes. Neuropathies are characterized by a progressive loss of nerve fibers and nerve fiber density. In both T1DM and T2DM, the common neuropathies are sensory neuropathies (Unger, 2007). These can be further classified into peripheral neuropathy, proximal neuropathy, focal neuropathy or distal symmetrical polyneuropathy. Peripheral neuropathy is the most common clinical type of diabetic neuropathy and can cause pain or loss of feeling in the toes, feet, legs, hands and arms. As an example, a cross-sectional study conducted by Davies, Brophy, Williams, and Taylor (2006) among people with T2DM to

determine the prevalence of painful diabetic peripheral neuropathy, its severity and impact on life, found 26.4% prevalence and a significant negative impact of peripheral neuropathies on their quality of life. These studies provide evidence that by controlling hyperglycemia by dietary modification, increasing physical activities and adhering to medication treatment are significant for reducing the debility due to diabetic neuropathy.

Diabetes foot syndrome is the other distressing microvascular complication. The presence of several characteristic diabetic foot pathologies such as diabetic foot ulceration, diabetic foot infections and neuropathy are called "diabetic foot syndrome". WHO defines diabetic foot syndrome as the foot of a patient with diabetes that has the potential risk of pathological consequences, including infection, ulceration and or destruction of deep tissue associated with neurological abnormalities, various degrees of peripheral vascular disease and/or metabolic complications of diabetes in the lower limb (Lipsky et al., 2004). Diabetic foot ulceration occurs in 15% of all patients with DM and precedes 84% of all diabetes-related lower limb amputations (Bream & Tomic-Canic, 2007). Furthermore, these foot disorders are one of the leading causes of hospitalization for persons with diabetes (Frykberg et al., 2000). Therefore, screening for diabetic foot is an important component of routine diabetes care. The above mentioned microvascular and microvascular complications have a greater impact on the quality of life (QOL) of patients with T2DM. The presence of two or more complications is associated with worsened QOL (Peyrot & Rubin, 1997) and in turn this is associated with greater severity of complications for patients with T2DM (Jacobson de Groot, & Samson, 1994). In summary, macrovascular and microvascular complications of T2DM can

result in a reduction of lifespan and create disabilities affecting every aspect of life leading to poor QOL. Therefore, glycemic control is crucial in prevention and control of these complications.

Glycemic Control Among Adults with T2DM

Since there is no cure for T2DM to date, the main goal of diabetes management is to control glycemic levels within normal or near normal levels (ADA, 2012). According to the ADA, (2012) normal glycemic levels are glycosylated hemoglobin level (HbA1c) <6.5% or FBS <126 mg/dl. HbA1c level represents the blood glucose status of the previous 120 days (ADA, 2012). ADA (2012) has recommended that patients with DM should attain HbA1c level below 6.5% because a UKPDS (1998) study demonstrated that HbA1c levels above 7% are likely to increase the risk of developing microvascular disease. Further, HbA1c is known to be the best indicator or the "gold standard" for long-term blood sugar control, as this test is not influenced by the acute glycemic changes, or by recent meals, gender, age and ethnicity (Unger, 2007). Glycemic control is highly needed among these with diabetes, because the elevated glycemic levels can cause the aforementioned life-threatening complications (ADA, 2012). Observational studies have stated that high glycemic levels increase the risk of complications among patients with T2DM (Selvin et al., 2004; Stratton et al., 2000). Moreover, results of randomized controls trials have demonstrated that the risk of microvascular complications can be reduced by intensive glycemic control in patients with T2DM (UKPDS Group 1998). Thus it could be concluded that glycemic control reduces the risk of diabetic complications among adults with T2DM.

Furthermore, a number of studies have evidenced that decreased calorie intake, and increased physical activities are promising to glycemic control and as a result decrease or delay the incidence of complications. For instance, 'Look AHEAD', a multi-center randomized control trial concluded that weight loss through decreased calorie intake and increased physical activity improved glycemic control with the mean HbA1c dropping from 7.3% to 6.6% among 5145 patients with T2DM (Ryan et al., 2003). A large observational study conducted in UK revealed that diet control was significantly associated with normalized fasting blood sugar levels among patients with T2DM (UKPDS Group, 1990). Hence, it could be concluded that glycemic control behaviors among adults with T2DM are significantly important to attain glycemic control.

Glycemic Control Behaviors Among Adults with T2DM

According to the T2DM-related literature, there are mainly three behaviors namely, diet control, regular physical activities/exercise, and adherence to medication regime, that are significantly important to achieve glycemic control. The following will discuss each of the glycemic control behaviors along with the interventions carried to improve these behaviors:

Diet Control

Diet control is known as first-line therapy for adults with T2DM. A controlled diet results in weight loss. Diet control is highly recommended for T2DM patients with excess weight to control glycemic levels to normal or near normal (ADA, 2012). According to Unger (2007), goals of diet control are: 1) achieving and

maintaining optimal metabolic outcomes, 2) achieving glycemic levels in normal or near normal range to prevent the risk for complications, 3) minimizing the glycemic variability and achieving a normal lipoprotein profile to reduce the risk for macrovascular complications, 4) lowering BP levels to reduce risk for vascular complications, 5) improving health through healthy food choices and physical activity, and 6) addressing individual nutritional needs (personal and cultural preferences and lifestyle, individual attitudes and readiness to change). Further, the specific diet control goal for patients with T2DM is to assist changes in food habits and physical activity which reduces the insulin resistance, support weight loss or minimize weight gain, and improves overall metabolic status (Unger, 2007).

Patients with T2DM on weight control diets, replacing carbohydrate with monounsaturated fat reduces post-prandial hyperglycaemia and triglyceridemia. As for the general population, people with T2DM are encouraged to choose a variety of higher fiber diet such as whole grains, fruits, and vegetables, because of its metabolic impact on glycemic control, hyper-insulinemeia and plasma lipid. Furthermore, a high fiber diet provides vitamins, minerals, fiber and other substances important for better T2DM control. According to ADA (2012) fiber recommendation for adults with T2DM is 20-35 gm per day. This is because dietary fiber is one of the factors that influence post-prandial glucose and insulin responses. Post-prandial glucose level and insulin resistance are also influenced by the macronutrient composition of meals, processing, cooking and other characteristics of the carbohydrates (Meyer et al., 2000; Rasmussen et al., 1993). Since there are considerable differences in the physiological responses to different forms of carbohydrate, the term glycemic index (GI) was coined in 1981 (Jenkins et al., 1981). GI is defined as the glycemic response

elicited by a 50g carbohydrate portion of a food expressed as a percentage of that elicited by a 50g portion of a reference food. GI is a measure of the post-prandial glucose response after carbohydrate consumption. Low GI foods have lower 2-hr areas under the glucose curve than the reference food, while high GI foods have higher areas. The knowledge of GI index has association with HbA1c, for example, ADA, (2012) guidelines state that use of GI may provide additional benefits for diabetics over those observed when total carbohydrates are considered alone. Several randomized control trials have reported that low-GI diets reduce hyperglycaemia (Brand-Miller, Hayne, Petocz, & Colagiuri, 2003; Shread, et al., 2004). A meta-analysis conducted by Brand–Miller et al. (2003) on low-GI diets among patients with diabetes showed that low GI diets produced a 0.4% decrease in HbA1c when compared with high GI diets. Weight loss can be achieved by decreasing the energy intake and increasing physical activity. A moderate decrease in energy intake (500-1,000 kcal/day) will result in a slow but progressive weight loss (1-2 lb week) (ADA, 2008).

Required protein intake of about 15%-20% of average energy intake is fairly consistent across all ages from infancy to elderly and appears to be similar in persons with T2DM. Meat, poultry, fish, dairy products and legumes are examples for good protein sources. Reduction of protein intake to 0.8 g/kg is recommended for patients with chronic renal and diabetic nephropathy (ADA, 2008).

Dietary fat containing a mixture of saturated monounsaturated and saturated fatty acids. The primary dietary fat goal for the patients with T2DM is to limit saturated fat and dietary cholesterol intake. Saturated fat is the main dietary determinant of plasma LDL cholesterol. ADA (2012) recommends that the daily

calories come from fat should be not more than 30% and less than 10% intake should be derived from saturated fats. Reducing dietary cholesterol to 300mg or less per day is recommended.

Salt can increase blood pressure and those with T2DM should limit the salt intake especially if they have hypertension, overweight or both. Overweight people who have a high sodium intake may be at higher risk for death from heart disease. ADA (2012) recommends that the patients with T2DM with nephropathy should limit their intake of sodium.

In terms of alcohol, individuals with T2DM, should limit their daily intake of alcohol to a moderate amount (one drink per day or less for women and two drinks per day or less for men) (ADA, 2012). Moderate amounts of alcohol when ingested with food have minimal acute effects on plasma glucose and serum concentration whereas carbohydrate co-ingested with alcohol may raise glycemic levels (Howard, Arnsten, & Gourevitch, 2004). Therefore alcohol should be consumed with food to prevent hyperglycemia.

Meal planning for those who try to control their T2DM by diet only and or with oral hypoglycemic agents (OHAs) is essential. Multiple small meals have been shown to have a positive impact on lipids, insulin and post-prandial glucose levels. Spacing meals throughout the day, is advisable, instead of eating heavy meals once or twice a day because it can help patients to avoid extremely high or low blood glucose levels (ADA, 2012). However, diet control behavior is the most challenging glycemic control behavior for many adults with T2DM (Franz et al., 2004; Rosal et al., 2001). This is because diet, food practices, meal planning, and intake of high fiber diets is influenced by the particular social cultural context.

Exercise/Physical Activity

In addition to dietary modification, regular physical activity/exercise has been recommended as one of the main components of glycemic control (Nathan et al., 2006). Doing exercise for the patients with T2DM can be beneficial mainly in three ways: 1) improvement in health (such as improvement in glucose regulation, weight control, lipid profiles, hypertension and increased work capacity), 2) psychosocial benefits (such as reduced anxiety, depression, stress, enhanced feeling of well-being) and 3) social benefits (such as increase in relationship with family members, participating in community-based activities) (Unger, 2007). Furthermore, Sanz, Gautier, and Hanaire (2010), in their review mentioned that physical activity/exercise should be a part of any therapeutic plan to slow the development of T2DM among high risk individuals and also to improve HbA1c in T2DM. In terms of frequency of exercise ADA (2012) recommends that people with T2DM engage in moderate intensity aerobic physical activity at least 30 minutes per day (150min /week). It is recommended that there should not be more than two consecutive days of physical inactivity for these patients with T2DM (ADA, 2012). Patients with T2DM who exercise three to four times per week lasting 30 minutes to 60 minutes can improve HbA1c levels 10% to 20% from baseline ADA (2012).

There are two types of exercises; aerobic and anaerobic exercises. Aerobic uses a continuous supply of oxygen. Aerobic exercise promotes cardiovascular fitness by increasing the pulse to a desired level and once the heart pumps more blood, it prevents the build-up of fatty deposits and blood clots. Aerobic exercise consists of rhythmic, repeated and continuous movements of the same large muscle

groups for at least 10 minutes at a time. Swimming, bicycling, jogging and aerobic dance are some examples for aerobic exercises. A number of studies have tested the effect of the above two types of exercise on glycemic control in adults with T2DM. A meta-analysis conducted by Thomas, Elliott, and Naughton (2006) to assess the effects of exercise on 377 adults with T2DM found that exercise interventions significantly improved glycemic control as indicated by a decrease in HbA1c levels of 6% (95% CI:-0.9 to 0.3; $p<0.05$). Furthermore, a systematic review and meta-analysis (including 47 RCTs, 8538 T2DM patients) conducted by Umpierre et al. (2011), to find the association of structured exercise training regimens with or without dietary modifications on changing of HbA1c in T2DM, mentioned that exercise training was associated with HbA1c reduction in patients with T2DM. Furthermore, they concluded that greater HbA1c reduction is associated with exercise training for more than 150 min/per week and also HbA1c is decreased when the exercise is combined with dietary modification (Umpierre et al., 2011). Therefore, it can be concluded that the importance of physical activity and dietary modification as behavior modifications in planning to reduce HbA1c in type 2 diabetics.

Adherence to Medication Regimen

When diet control, and exercise fails or is not enough to control glycemic levels to accepted levels, blood glucose lowering drugs or anti-hyperglycemic agents should be initiated, either as OHAs or insulin. In general all patients with T2DM treated with OHAs will eventually require insulin to treat their hyperglycemia because of the progressive nature of the T2DM (ADA, 2012). Commonly used OHAs are categorized as 1) insulin secretagogues, (sulphonyelurea and non-sulphonylureas),

2) biguanides, 3) thiazolinediones, 4) alpha-glucosidase inhibitors and 5) peptide analogs (dipeptidase-4 inhibitors). Sulphonylurea (e.g.Cholopropamide, Tolbutamide, Acetohexamides, Glipzide) and non-sulphonylureas (e.g.Meglitinides, Repaginate) can stimulate insulin secretion so they are named as "insulin secretagogues" and as a result, insulin will be released into the portal vein (Unger, 2007). Metformin is the most commonly used biguanide and it is distinct to sulphonylureas by acting as an "insulin sensitizer". The ADA (2012) guidelines recommend that next to lifestyle behaviors, metformin should be started in all newly diagnosed T2DM patients if no contradictions exist. This advice is based on the UKPDS (1998) that metformin is effective on lowering HbA1c with less weight gain compared to other therapies (sulphonylureas and insulin) and also leads to significant improvement in cardiovascular outcomes and overall mortality. Thiazolinediones (e.g. Avandia, Actos) reduce insulin resistance by acting on muscle, on fat and to a lesser extent, on liver to increase glucose utilization and to diminish glucose production and is often used as monotherapy (Unger, 2007).

The discovery of insulin in 1922 is one of the most remarkable achievements in medicine and insulin is commonly used with patients with T1DM and those who are severely hyperglycemic (Unger, 2007). There are many acceptable approaches to the initiation of conventional insulin therapy. Initially the dose of the intermediate-acting insulin should be adjusted to pre-dinner and fasting (morning) glucose levels. Once these goals are achieved, rapid acting insulin doses should then be adjusted to optimize postprandial, pre-lunch and bed time glucose values. Continuation of optimal insulin therapy will help to preserve residual β–cell function (Unger, 2007).

In addition, the patient with DM should be educated about the name of the drugs, dosage, route, and correct time to take these medicines. The patients with T2DM should take insulin especially before having a meal. If the patient with T2DM does not adhere to their medications, the blood glucose control will be suboptimal and thus lead to developing acute and/or chronic complications. Knowledge about the side effects of these medicines is also important because hypoglycemia is a common side effect and if the patient is unaware of this, it will lead to serious complications. Furthermore, the patient should not discontinue the prescribed medicines without medical advice.

Thus it can be concluded that the above mentioned glycemic control behaviors are crucial to achieve in glycemic control among adults with T2DM. Moreover, these behaviors are cost effective in glycemic control. However, research studies demonstrate that patients with T2DM are not practicing them properly (Sabete, 2003), and glycemic control behaviors are not easily adopted by most patients with T2DM.

Sociocultural Factors Influencing Glycemic Control Behaviors Among Adults with T2DM

Many studies have revealed that the majority of adults with T2DM do not achieve optimal glycemic control despite the provision of effective interventions. This may be because, although glycemic control behavioral interventions, diabetes self-management education interventions are promising for glycemic control, the adoption of interventional strategies may be expensive, inappropriate or unacceptable to certain ethnically, socially and culturally diverse populations. Thus, the American

Associations of Diabetes Educators (AADE, 2012) pointed out that increasing the opportunities for successful patient outcomes will require thoughtful consideration of individuals' and communities, and sociocultural factors in the designing and delivering of glycemic control interventions. Sociocultural factors are one of the many factors that influence glycemic control behaviors among adults with T2DM and the significance of considering these factors in order to provide culturally congruent care for adults with T2DM need to be recognized and acted on (Caban & Walker, 2006: Chun & Chesla, 2004; Fleming & Gillibrand, 2009). These factors can be categorized as: Cultural influence (cultural beliefs towards the illness, attitudes towards the illness, religious beliefs and spiritual practices, beliefs and use of traditional medicine), Socioeconomic status (poverty, educational level, type of occupation and working hours), Social support (family support, peer support); and health care related factors (health care facilities, attitudes and beliefs of health care personnel, access to health care). These factors impacting on glycemic control behaviors among adults with T2DM are described below.

Cultural Influence

Cultural beliefs towards DM. Culture is defined by the Oxford Dictionaries (2011) as the ideas, customs, and social behavior of a particular people or society. According to Kleinman (1980) and Helman (2001) a person's culture has been identified as an aspect of which may potentially influence the way one chooses to self-manage their illness. Cultural beliefs towards to diabetes have an impact on health behaviors both positively and negatively (Hunt, Pugh, & Valenzuela, 1998; Daniulatyte, 2004). As an example, a study conducted by Smith (2012) among 30

adults Afro-Caribbean women with T2DM, demonstrated the influence of their cultural beliefs in living with diabetes (e.g. “eat everything in moderation… there is nothing I cannot eat… but it moderation and not too often…” p.644), the latter is an example of the positive impact of cultural beliefs on T2DM and its management.

The negative impact of cultural beliefs related to the cause of diabetes can be explained by the results of a qualitative study conducted by Carbone, Rosal, Torres, Goins, and Bermudez (2007) among 37 adults with T2DM. The researchers found that a number of their participants had cultural beliefs towards to cause of the diabetes such as they were born with diabetes and could not be cured (e.g. “we are born with diabetes… among Puerto Ricans… diabetes is run in our blood when we were born…” p. 205), thus influencing their self–care behaviors and not adhering to self-care. Another study in Bangladesh, found that sufferers believed that the onset and the control of diabetes depended on the balance between the food entering into the body and the emission of body fluids, such as sweat, semen, urine, and menstrual blood (Greenhalgh, Helman, & Chowdhury, 1998). Beliefs among Chinese adults with T2DM expressed that the cause of diabetes was the imbalance of the hot and cold of the body, and the need to balance this hot and cold by taking some special food, medicine and doing activities which can lower body temperature (e.g. “I have a method that I used to lower the body sugar level through lowering my body temperature…” p.772) (Chun & Chesla, 2004). These kinds of beliefs may facilitate or act as barriers to performing glycemic control behaviors. Therefore, exploring cultural beliefs about DM is beneficial for health care personnel to understand how and why patients with T2DM follow recommended health behaviors or not.

Furthermore, in all human societies eating food is more than just a source of nutrition. It plays an important role and is deeply embedded in the social, religious and cultural aspects of everyday life. Previous research indicated that cultural beliefs, values and traditions impact on food beliefs and practices, food choices and a desire to eat influencing diet control behavior among people with T2DM. In terms of food beliefs and practices, for example, Chowdhury, Helmen, and Greenhalg (2000) studied 40 British Bangladeshis with diabetes. Their in-depth interviews revealed that food were classified as "strong/weak" and "digestible/indigestible" based on their cultural beliefs and ethnic patterns rather than Western notions of food values (protein, carbohydrate, fat). Further they concluded that dietary advice given to those with T2DM needs to be concerned with different food beliefs and practices. The choice of food and the desire to eat it act as a challenge for patients with DM on their diet control behaviors. A qualitative study conducted by Chesla, Chun, and Kwan (2009) explored cultural challenges to manage T2DM among 40 adult Chinese with T2DM in America. A number of their participants mentioned that their food choice affected their diet control behaviors (e.g. "if we can't eat what we want, as we want there is no meaning to life now", "If we don't eat rice we cannot sustain our daily living…" p.1814).

Furthermore, a study of Smith (2012) among 30 adult Afro-Caribbean women with T2DM, found that participants struggled to modify their traditional Caribbean diet in order to control the intake of high sugar containing food. Another study among adult Hispanics Americans with T2DM mentioned that "it is extremely difficult to have diabetes as Latino… we Puerto Ricans love to eat our pastels (meat), rice, beans, chicken other meats but the diabetic cannot eat any of that..." (Hatcher &

Whittemore, 2007, p. 540). Such studies demonstrate that in some cultures, eating rice, more meats, more sweets are inherent in their culture but patients with DM are advised to not to eat them. Some cultural beliefs lead patients to be unhappy in their diet control behaviors. As an example, a study of accommodating T2DM in Chinese American families highlighted that "in Chinese culture if someone is sick, we don't tell them not to eat; instead we buy more things and eat more… I felt frustrated in the beginning… because all the time telling me not to eat, don't eat…" (Chesla & Chun, 2005, p. 245). This shows how Chinese cultural beliefs influence such patients to be unhappy with dietary control. Consequently, people with T2DM live and grow in such culture, and may be resistant to diet control because they believe that if they cannot eat as they learn and practice in their culture it may lead them to be dissatisfied with life. In addition, Patel, Morrissey, Goenka, James, and Shaikh (2001) found that when caring for Hindus, traditional Western approach of dietary management is not always appropriate because of different cultural practices and food choices. Hence it is apparent that it is important to understand the cultural beliefs influencing food beliefs and practices, and food choices to control diet in order to provide culturally appropriate care for adults with T2DM.

Helman (2001) mentioned that in particular cultural contexts, people believe some food serve as medicine in addition to its nutrient value, while other studies mentioned that many adults with T2DM used some food as medicine to control their glycemic levels. Several traditional food (e.g. bitter melon, ivy gourd, fenugreek seeds) were reported to be widely used as home remedies for T2DM among Asian Indians due to their perceived cultural beliefs related to these food (Krawinkel & Keding, 2006). Thus some cultures beliefs and use of food as medicine may or not

interfere with the Western medicine adherence, and this needs to be understood by health care personnel.

There is evidence regarding the impact of different cultural beliefs on physical activities /exercise behavior among patients with T2DM. Lawton, Peel, Parry, and Douglas, (2008) conducted a qualitative study among 23 Pakistani and 9 Indian patients with T2DM to explore their attitudes and beliefs on physical activity as part of their self-care. The research group found that fear, shame, lack of culturally sensitive facilities (in cases of cultural taboos such as not being allowed to swim) act as barriers to do physical activities (Lawton et al., 2008). In some cultures women may not be allowed to go out for exercises, for example, in Bangladesh women rarely leave their house apparently through fear of being physically attacked (Greenhagles, et al., 1998). In some cultures women believes that housework is sufficient exercise (Hatcher &Whittemore, 2007). Such beliefs may act as barrier to performing exercise behaviors although adults with T2DM know they have to do this. Hence, it is important to explore the underlining cultural beliefs about exercise behavior among adults with T2DM rather than labeling them as non-complaint patients. In summary, as mentioned above, cultural beliefs related to diabetes causation, diet control, exercise and medication taking among adults with T2DM need to be understood by health care personnel. This kind of awareness would facilitate health care personnel to provide culturally appropriate care.

Attitudes towards DM. Studies have shown that attitudes towards illness among people living in a particular culture influence their health behaviors. In Jordan, Khattab, Khader, Al-Khawaldeh, and Ajlouni (2010) studied factors associated with poor glycemic control among 917 patients with T2DM. Their study

revealed that of the 917 patients 65.1% had HbA1c>7% and had negative attitudes towards self-care behaviors. Fear of injury among adults with T2DM act as a negative attitude to do exercises more often than people without DM (Huebshman et al., 2011). People with T2DM often neglect or ignore doing regular exercise due to lack of interest, shame, lack of motivation, and stressful life situation (Mier, Medina, & Ory 2007; Wen, Shepherd, & Parchaman, 2005; Whites, Terry, Troup, & Rempel, 2007). The reasons behind the lack of interest to do exercise can be further explained as the individuals' busy schedules of their daily activities and work leave little time to do exercise. Often adults, whether they have T2DM or not, have many family responsibilities, thus they are physically active in their daily life. Hence, due to this kind of attitude they have a lack of interest to do additional physical activities, even though they are advised to do so.

Regarding attitudes to adhering to medication regimen behavior, Campos (2007) conducted a review on barriers to successful use of insulin in Hispanics with T2DM. Most participants had attitudes that insulin injections will be too painful, or insulin injection may cause blindness and then they did not get their insulin injection properly. Such attitudes may have a negative impact on medication adherence behavior. An exploratory survey carried out by Farmer, Kinmonth, and Sutton (2006) among 121 adults with T2DM found that 24.1% had negative attitudes such as diabetes medication has unpleasant side effects, and 13.9% believed that diabetes medication led to weight gain. These attitudes caused poor adherence to their medication taking behavior. Lai, Chie, and Lew-Ting (2007) conducted a qualitative study on how patients with T2DM' attitudes of illness affected non-adherent behaviors. The researchers found a number of their participants believed diabetes

cannot be cured anymore and this influenced their adherence behaviors. In another qualitative study, African-Caribbean adult participants with T2DM mentioned that "I only take medication when I have cold… other than that I don't like to take tablets…" (Brown, Avis, & Hubbard, 2007, p.465). Thus it is obvious how patients' attitudes influence medication adherence behavior, and again this needs to be considered by health care personnel in order to educate and motivate adults to perform their glycemic control behaviors.

Religious beliefs and spiritual practices towards the illness (DM). Religious beliefs are highly valued in most cultures such as Asian, Indian communities and may affect dietary patterns because there are different dietary codes and laws for each religion (Kulkarni, 2004). In Thailand, Lungberg and Thrakul (2012) conducted a descriptive qualitative study among Thai Buddhist people with T2DM. Study findings indicated that a reference to "Buddhists' moderation" can be an effective means of helping people with diabetes better manage their life styles. Similarly, in Sowattanangoon, Kotchabhakdi and Petrie study on the influence of Thai culture on diabetes management in 2009, some aspects of Buddhist religion such as "Buddhist values of self-control" contribute positively to dietary control among their participants. Another study of Patel et al. (2011) found that Hinduism emphasizes the "spirit of balance" in all aspect of life leading to diabetes control among Hindus. Some of the studies conducted among African American women with T2DM have reported that God or Jesus plays central role in their self management in day-to-day life (Samuel-Hodge et al., 2000). Smith (2012) found that most of her participants practiced prayers in order to get help to control their diabetes (e.g. "I pray about everything and God will answer prayers, I feel better" p.644). In Brown et al.'s study

(2007) of health beliefs among African–Caribbean with T2DM, "Christian faith" influenced their blood sugar control. Many participants' believed that the outcome of their diabetes was in the hand of a higher power (e.g. "whatever will happen is what is… it is within your destiny… I just have to see the life in that way because worrying is not going to help any more…" p.466). Many studies conducted with Muslims diagnosed with T2DM reported that Islamic norms of avoiding animal fat is incorporated into their diet alongside the requirement of self managing diabetes whereas patients with diabetes are advised to reduce the amount of animal fat (Chowdhury et al., 2000). Hence, it is evident how different religious beliefs impact on dietary practices and on other means to manage diabetes among adults withT2DM.

Some studies have evidenced that religious belief among adults with T2DM are useful to manage their stress levels (Hunt, Arar, & Akana, 2000; Sowattanangoon, Kotchabhakdi, & Petrie, 2009). For example, Utz et al. (2006) conducted focus group interviews with 68 African American adults with T2DM, and identified that the majority of their participants used spiritual practices to facilitate their stress levels. Another study conducted by Jones et al. (2006) with 73 African American adults with T2DM had similar findings. Participants reported that prayer and faith in the Bible helped them make daily decisions, such as deciding what foods to eat. Prayer also gave them the daily strength in caring for their diabetes. Casarez, Engebreaton, and Ostwald (2010) conducted a descriptive qualitative study to assess spiritual beliefs and self-management among 16 African American individuals with T2DM. The findings revealed that participants do spiritual practices that have influence on their self-management behaviors (e.g. diet control, stress management, taking medication) and concluded that such practices can be useful as resources in care (Casarez et al.,

2010). Thus it can be assumed that different religious beliefs and spirituality practices have influenced some of the glycemic control behaviors among adults with T2DM.

Beliefs and use of traditional /complementary medicine. Further, the use of traditional medicines or complementary medicines along with the western medicine therapies by adults with T2DM has gained greater popularity over the past 20 years. The uses of "traditional/folk therapies" are common cultural practices in many societies. Chacko (2003) investigated the use of complementary therapies to manage blood glucose levels among adults with T2DM in India using ethnographic methods. It was revealed that participants' decisions about controlling their blood glucose levels closely related to their cultural background. They frequently used traditional medicines and folk herbal remedies to supplement western medicine to control their glycemic levels. Rivera, Ortiz, Lawsome, and Verma (2002) and Najm, Reinsch, Hoehler, and Tohis (2003) reported the use of folk healers in diabetes care among Hispanics. In addition to seeking care from folk healers, the beliefs and use of home remedies were most frequent. Individual interview and focus groups conducted with Mexican-American in Texas by Poss, Jezewski, and Stuart (2003) revealed that almost all participants integrated standard medical and alternative methods in their diabetes control. Thus in summary, the beliefs and the use of folk healers and alternative/complementary medicines to control blood sugar level among adults with T2DM is a common practice in many cultures.

Socioeconomic Status

Economic status. Diabetes-related studies have revealed that the patients' economic status influences the dietary control behaviors among adults with T2DM. A cross-sectional study conducted by Daly et al. (2009), identified barriers to diabetes self-care among randomly selected 253 adults with T2DM. Findings revealed that economic status was the commonest barrier to adhere to diet, exercise and medication adherence behavior (Daly et al., 2009). Low-income status has been shown to affect the avoidance of healthy foods such as low fat foods, fruits, and vegetables. As an example, Kwan, Razzaq, Leiter, Lillie, and Hux (2008) studied socioeconomic status influences on dietary behavior and blood glucose levels among 387 patients with DM in Ontario, Canada. Results revealed that low income was an independent predictor of not purchasing healthy food (OR 3.44, 95% CI 2.29-5.10) due to cost, skipping blood glucose testing (OR 1.88, 95% CI 1.10-3.19) and the absence of health insurance was an independent predictor of skipping blood glucose testing (OR 4.37, 95% CI 2.71-7.05). Similarly, Albarran, Ballesteros, Morales, and Ortega (2006) conducted a study to explore risk factors modification, barriers and facilities for behavior change among 48 urban adults with T2DM in Mexico. Their focus group findings revealed that low income is a barrier for them to adhere to diet control and medication adherence behaviors. In conclusion, the above studies reported that low socioeconomic status of adults with T2DM act as a barrier to glycemic control behaviors which led to poor glycemic control.

On the other hand, middle or high economic status also influences glycemic control behaviors. As an example, in terms of middle income and its association with

diet control and exercise, a cross sectional survey was conducted on 225 middle income patients with T2DM in Ethiopia (Ayele, Tesfa, Abebe, Tilahun, & Girma, 2012). They found that those with middle incomes had less barriers to diabetic diet control and physical activity behaviors. Having a middle or high income may lead patients with T2DM to access healthy food such as low carbohydrate, low fat and less sugar containing food which are recommended to them and avoid unhealthy food such as high calorie instant food that are not recommended for them. Patients with middle or high incomes may have inactive or sedentary life status which may lead to less physical activities. This is because middle or high income adults with diabetes may have access to modern conveniences like cars to go to their work and spend time sitting in front of the computers at their office or spend leisure time watching television. In summary, it can be concluded that having middle or high income may act as facilitators or barriers to diet control, physical activity and medication taking behaviors in turn affecting the glycemic levels of T2DM.

Poverty. Low socio-economic status is an important factor in T2DM. Poverty can cause higher incidence of T2DM and also influence patients' self-care. Hsu et al. (2012) examined the association between poverty and incidence of diabetes and inequality to assess care under the national health coverage insurance program in Taiwan. They have found that low income patients with T2DM were less likely to visit any diabetic clinic (OR, 0.4; $p< 0.001$) and to receive tests for HbA1c levels. It highlighted that poverty is associated not only with higher diabetes incidence but also with inequality of diabetic care in Taiwan, despite having health coverage. In USA, having a family income below poverty level was associated with a twofold higher mortality with adults with diabetes in the highest family incomes (Relative risk =2.41,

95% CI 2.05-2.84) (Saydah & Lochner, 2010). A number of life science research studies have shown that due to poverty, people including patients with T2DM consume an excess of nutritionally useless, cheap high calorie food, processed food and junk food. Consumption of this kind of food may cause obesity and poor diet control among patients with T2DM. Further due to poverty, the availability of nutritional food and the accessibility of such food, so called food insecurity is limited or uncertain (Seligman, Jacobes, Lopez, Tschann & Fernandez, 2012). Seligman et al. (2012) conducted a cross-sectional survey among 711 diabetic patients in Chicago to determine the association between food insecurity and glycemic control, and whether this association mediates the difficulty in following a healthy diet. They found that food insecurity is an independent risk factor for poor glycemic control and increased difficulty in following diet appropriate for diabetes. Another recent study of Chaufan, Davis, and Constantino (2011) examined the social determines of health in general and disparities among 15 adults with T2DM in United States. Their qualitative findings highlighted that low income, living at or below poverty level, having low education, doing non-permanent jobs, and access to proper nutrition severely restricted their diabetes control. Their participants reported repeatedly that a low income restrict them from having healthy food (e.g. “we often don’t buy healthy food so that we can pay the house rent, only if there any money saved we can buy them.”), and temporary jobs make their life difficult (e.g. “my husband has three jobs, part time jobs, he get up early and goes to work, he don’t have time to eat regularly”). These excerpts demonstrate the impact of poverty on among adults with T2DM (Chaufan et al., 2011, p. 1039). Thus it can be concluded that poverty may have

significant impact in some of the glycemic control behaviors which lead to glycemic control among adults with T2DM.

Level of education. A persons' educational level has an impact on his/her health behaviors. It is also known that higher socioeconomic groups may have healthier diets because they may have higher educational levels, be more health conscious and have healthier life styles. Murata et al. (2003) conducted a study among 180 adults with T2DM patients in the USA and found that age and years of schooling were well correlated with their educational level ($r=0.537$; $p< 0.001$) in turn to have better blood sugar control. Another study conducted by Miech, Kim, McConnell, and Hamman (2009) showed a decrease in the prevalence of DM complications and a relatively lower HbA1c levels among those with higher education. Therefore, patients' educational level may directly affect the diabetes knowledge and potentially indirectly impact on their glycemic control behaviors. It is already known that if patients have higher educational levels, they are more likely to seek knowledge related to their disease and how to control their decease. Higher education assists a person to have basic knowledge such as what is diabetes, how to read and understand blood sugar reports, why the need to control diet, to do exercise, check blood sugar level, need medication, what are the complications, and so on, and thus they would be more likely to adhere to the prescribed treatment and maintain blood glucose levels within normal or near normal levels. As an example, Savoca and Miller (2001) explored beliefs and perspectives about diet, food choices and eating patterns among 45 adults with T2DM. In their in-depth interviews, they found that participants' knowledge of DM management influenced their eating patterns. Diabetes-related knowledge is important for effective meal planning too. Early,

Shultz, and Corbett (2009) conducted a qualitative study among 18 adults with T2DM by using in-depth interviews to examine the dietary behaviors used to achieve diabetes self-care goals. They found that most respondents successfully identified dietary behaviors such as less carbohydrate, fats, and caloric diet, buying different food, resisting temptation and being strict to the plan and wanting to be healthy. On the other hand, lack of diabetes-related knowledge may be a barrier for not practicing appropriate glycemic control behaviors. Lawton, Ahmad, Hallowell, Hanna, and Douglas (2005) found that patients' lack of understanding of diabetes, how medications, food and exercise influences glycemic control, how to use glucose monitoring results, and what kind of information need to be known, act as barriers to self-care behaviors. In another study Nagelkerk, Recik, and Meengs (2006) explored perceived barriers and effective strategies used by 24 adults with T2DM by using focus groups and found that the most reported barrier to practice dietary behavior is lack of knowledge about specific diet plans, lack of understanding about the plan of care, and frustration from poor glycemic control in turn affecting their adherence to the treatment. In line with these evidence, many interventions are carried out to improve diabetes-related knowledge among adults with T2DM (Albarran et al., 2006; Hornsten, Lundman, Stenlund, & Sandstrom, 2005). Therefore, it can be concluded that in patients with T2DM, educational level has an impact on both knowledge related to diabetes and glycemic control behaviors which need be considered in planning and implementing care for them.

Type of occupation and working hours. Some studies have identified that in patients with diabetes, the type of occupation and working hours have an impact on glycemic control. As for instance, Davila in her study (2010) indicated that

those who are farm workers and working over 40 hours/week had suboptimal glycemic control (HbA1c ≥ 7%). Furthermore, Davila et al. (2011) assessed the relationship between glycemic control and working hours and type of occupation among 369 employed US adults with T2DM. The research group reported that adults who working over 40 hours/week were more likely to have suboptimal glycemic control (HbA1c ≥ 7%) compared to those who were working 20 hours or less (odds ratio = 5.09; 95% CI [1, 38- 18.76] and agricultural workers were more likely than white collar workers to have suboptimal glycemic control. Further they concluded that working hours should be considered in the development of workplace polices and accommodation for the increasing number of workers with T2DM (Davila et al., 2011). As stress increases the glucose levels in blood, long-term working hours may exacerbate the increase of the stress levels and this may be the reason for this suboptimal glycemic control among these patients with T2DM.

Social Support

This includes family, peer and friends' support. As T2DM is a chronic disease requiring many activities to control blood glucose levels, a patient's family has an important role in terms of support. If the family member can be involved in the diabetes care, the patient can share the responsibility with the family member leading to patient motivation to adhere to behaviors. Many studies have revealed the importance of family support in order to do diet control behaviors among adults with T2DM. Wen et al. (2005) conducted a explorative, descriptive cross-sectional study to examine the relationship between diabetic-specific family support with regard to diet among 55 years and older, 138 Mexican Americans with T2DM. Results

revealed that a high level of perceived family support was associated with higher reported levels of diet control and living with a family member is associated with high levels of diet control. They concluded that diabetes educators and health care providers should consider involving family members in the management and intervention of patients with T2DM.

Some studies reported that diet control behavior for a family member who has diabetes is a challenge in day-to-day life and also disturbs their family relationships (Thomson et al., 2000). This may be perhaps because usually in many families food is often prepared for a large number of family members. The aim of such kind of cooking is to fulfill the food needs of the members of the whole family. Then it may be difficult to meet the specific dietary needs of an individual. Moreover, a diabetic diet which consists of low carbohydrates, low fat, and low salt prepared specifically for one's physical health has a different taste and appearance compared with a normal family diet. This kind of diet prepared separately from the normal family diet, is time consuming, burdens the family finances and requires extra work. On the other hand, if the family members do not support a family member with T2DM, it will be difficult to them to practice their glycemic control behaviors. As an example, a qualitative study conducted by Carbone et al. (2007) among 37 adults with T2DM found that some participants cannot adhere to diet because of a lack of family support (e.g. "my wife gives little importance to my diabetes, she cooks food that I am not supposed to eat and if I don't eat she said she will not cook food for me again…"p. 205). In a study by Wen et al. (2005) realized the importance of family support in order to do physical activities and exercise behaviors among adults with T2DM. Chlebowy, Hood, and LaJoie (2010) study on facilities and barriers to self-

manage of T2DM among Urban African American adults provides a good example for family support and peer support on medication adherence behaviors and exercise behaviors (e.g. “My wife… she helps me take my medicine… my daughter tells me when to take medicine… I think buddy system is very good… I have a buddy to exercise with me… it is hard to exercise by myself only…” p. 902). Mayberry and Osborn (2012) explored the relationships between participants’ perception of family members’ diabetes specific supportive and non supportive behaviors, medication adherence and glycemic control among 45 adults with T2DM by using focus groups. Family members’ non-supportive behavior was associated with fewer adherences to medication regimen among study participants. They concluded that diabetes-related interventions should inform family members about DM and enhance their motivation to facilitate medication adherence behaviors.

With regarding to peer support, Heisler (2007) provided a brief overview of peer support for diabetes self management. The author defined peer support as “support from a person who has experiential knowledge of a specific behavior or stressor and similar characteristics as the target populations” (p. 2) and specifically highlighted the significance of peer support in taking insulin. Peer support sharing experiences with others undergoing the same medical problem or behavioral task is an effective means of increasing skills and improving disease outcomes (Heisler, 2007). A randomized control trial was conducted by Heisler, Vijan, Makki, and Piette (2010) with 244 men who had HbA1c greater than 7.5% in the USA. Patients in the peer support group had a reduction in the mean HbA1c level decreased from 8.02% to 7.73% compared to the nurse care management group. The same researchers discovered that peer support is a promising method for glycemic control. As peers

those who have the same experience beforehand can support the other patients more effectively through peer support. Further peer support can be less resource intensive than many other diabetes management programs.

Studies have been conducted to assess the social support impact on diabetes self-care behaviors among adults with T2DM. Zhang, Norris, Gregg, and Beckles (2007) examined the relationship between social support and mortality among 1431 older persons (age ≥70 years) with diabetes using data from a longitudinal study. They found that, the risk for mortality has been shown to be 55% lower among elderly diabetic patients with high social support (hazards ratio = 0.45, 0.21-0.98.) and concluded that social support is strongly associated with mortality. A cross-sectional analysis conducted by Okura, Hesiler, and Langa (2010) among 1097 adults with diabetes in USA demonstrated that higher levels of social support availability for adults with diabetes to control their glycemic levels needed to include interventions carried out for better glycemic control. Fortman, Gallo, and Phills-Tsimikas (2011) examined the relationship among social support, diabetes self-management and HbA1c levels among 208 Latino men and women with T2DM in USA. Their study reported that greater social support led to better diabetes self management ($\beta = .40$, $p < .001$) and tight glycemic control (HbA1c; $\beta = .15$, $p < .05$). On the other hand, lack of social support acts as a barrier to adhere to self care. A qualitative study conducted by McCloskey and Flenniken (2010) among 50 Hispanic adults with diabetes identified lack of social support as barriers to adhere to self-care. Thus, it can be concluded that adults with T2DM have to perform many self-care behaviors and having family, peer, and social supports can influence glycemic control, and social factors need to address in intervention plans to improve to glycemic control.

Health Care Related Factors

In each society the availability and utility of health resources have significant roles in improving the health of members. Unsatisfactory glycemic control reflects not only the lack of self-care on the part of the individual but also on the part of the health care provider in failing to initiate or intensify the therapy approach (Aljasem, Peyroot, Wissow, & Rubin, 2001). Hence the availability of health resources, health care personnel attitudes, beliefs, and facilities for the T2DM care are also significant in improving glycemic control behaviors among adults with T2DM. In terms of health care resources, Wellard, Rennie, and King (2008) conducted a study to explore issues regarding self-care among adults with T2DM by using a qualitative interpretive design, and found that difficulties in accessing health services included long waiting times, difficulties in making appointments, health care personnel failing to acknowledge patients' self-care knowledge and practices as barriers to their self-care. In order to overcome these issues the researchers suggested increasing communications between health care personnel and patients with T2DM, and the need to further develop strategies to improve community-based services for patients with T2DM. According to Zgibor and Songer (2001) limited access to care, physician attitudes towards treating diabetes and physician practices were identified as barriers to glycemic control. Rhee et al. (2005) conducted an observational cross-sectional study to examine whether differences in health care access affected HbA1c levels among 605 African American adults with T2DM. They identified that patients who had difficulty in obtaining care, had higher HbA1c levels (9.4% vs. 8.7%; p=0.001) and highlighted that policy decisions for improving diabetes outcomes

should target barriers to access health care among these populations. Ali, Bullard, Imperatore, Barker, and Gregg (2012) mentioned that access to health care, quality of care delivery and having health insurance are the characteristics associated with glycemic control among adults with T2DM. When considering the access to care by the residence of the patient, people who live in rural areas may have difficulty in accessing health care due to a lack of a health care center, or limited transportation facilities compared to those who are living in urban areas. Further, availability of health care personnel (physicians, nurses, dieticians) is also inadequate in rural settings and this may have an impact on glycemic control among adults with T2DM.

Evidence shows that support from health care provider, communication and health care resources act as influencing factors or barriers to adherence to glycemic control behaviors among adults with T2DM. Ofteda, Karlsen, and Bru (2010) for example, conducted a qualitative study using focus groups to explore the support from health care personnel as perceived by 19 adults with T2DM. They identified five themes reflecting perceived attributes of support from health care personnel such as an empathetic approach, practical advice and information, involvement in decision making, accurate and individualized information, and on-going group based support. This means patients with DM expect that their healthcare givers will understand their condition and support them to manage their blood glucose levels. Furthermore, a study conducted by Heisler, Bouknight, Hayward, Smith, and Kerr (2002) on patient-provider communication showed significant association with the overall self-management by patients with T2DM. Participants perceived that the guidance provided by the physicians (information about the disease, medications and treatment options) were important. Many qualitative studies of patients with T2DM and their

health care providers focused on their perceptions of interactions with their clinicians and highlighted that patients had difficulties in communicating with them (Matthews, Peden, & Rowles, 2007; Oftedal et al., 2010; Peek et al., 2010). Interestingly, the finding from studies exploring physicians' perception toward their patients with DM reported that communication problems and lack of treatment options overwhelmed the physicians in providing care (Beveraly et al., 2011; Wen et al., 2005). Thus, the patient-provider healthcare relationship is important for better communication between the patient and the healthcare provider, and possibly motivate adherence to glycemic control behaviors.

In summing up, the above evidence demonstrates the impact of socio-cultural context on diet control, regular physical activities/exercise and adherence to medication regimen behaviors among adults with T2DM. Thus it is worthwhile understanding the impact of such sociocultural contexts on glycemic control behaviors in order to improve the behaviors among adults with T2DM. It is important to explore and understand the socio-cultural contexts among adults with T2DM in order to provide culturally appropriate care for them. Unfortunately, even though T2DM is a major health problem in Sri Lanka, to date there is little information about how Sri Lankan sociocultural context influences the glycemic control behaviors of adults with T2DM. Without such understanding, sustainable and effective outcomes may not be possible in Sri Lanka.

Glycemic Control Among Adults with T2DM in Sri Lankan Context

Following is a presentation on Sri Lanka, its health system, diabetes problems and traditional health behaviors in the country.

Overview of Sri Lanka

Sri Lanka is an island of approximately 65, 610 square kilometers of land mass, situated in the Indian Ocean off the southern tip of India; with an estimated population of 20.6 million (Department of Census and Statistics, 2010b). Sri Lanka can claim a long history of civilization based on irrigation and agriculture of over 2500 years (De Silva, 1981).

The census data of 2007 confirms that Sri Lanka is a multi-ethnic, multi-linguistic and multi-religious country. Multiple ethnicities comprise Sinhalese (74%), Tamils (18%), Muslims (7%) and the remaining 1% of other ethnic groups (Department of Census and Statistics, 2007). Sinhalese is spoken by 74% of the population and is the official and national language (Department of Census and Statistics, 2007). English is commonly spoken by government officials and those from the higher socio-economic strata, i.e. about 10% of the population (Department of Census and Statistics, 2007). The multi-religious groups comprise Buddhists (65%), Hindus (15%), Islamists (7%), Christians and Roman Catholics (8%) (Department of Census and Statistics, 2007).

Administratively, the country is divided into nine provinces, 25 districts and over 300 Divisional Secretarial areas. Sri Lanka is now a middle-income country since it reached a per capita gross domestic product (GDP) of $2,000 in 2010

according to World Bank Report (2011) figures. It leads the region in the human development index (HDI) with a score of .76 and thus performs much better than comparable economies (World Bank Report, 2011). Poverty as measured by the Household Income and Expenditure Survey, declined from 15% in 2006/2007 to 7.6% in 2009 (Department of Census and Statistics, 2010a). The latest World Bank estimate has a different definition of poverty and relates to 2002 and constitutes 37.6% of the population. Sri Lanka's rate is better than that of Nepal, India and Pakistan (World Bank Report, 2011). In terms of education in Sri Lanka, for over six decades the population has had access to free education. The free public education system remains the predominant education service provider of general education in the country. Sri Lanka takes pride in supporting its free education throughout primary and secondary school levels as well at university level and in adhering to ethics and standards as declared by provisions in international conventions. As a result, there is an outstanding 91.4% literacy rate in the country (Department of Census and Statistics, 2010b). There is a strong tradition of both men and women working with men focusing more on income generating opportunities and women focusing more on the household (Little & Sabates, 2008). In general the status of women has always been and still is lower than men in the traditional conservative society of Sri Lanka. Moreover, in Sri Lanka the use of newspapers, television sets and radios, are relatively popular media for providing health information to the nation.

Health System in Sri Lanka

Sri Lanka has an extensive network of health institutions. It is estimated that no one has to travel further than 1.4 km to reach a fixed health facility (MOH, 2007). Free health care is allocated 4.1% of the GDP. As a result there is high expectancy of life (for females 76.4 years, for males 71.7years), a low infant mortality rate of 11.7 deaths/1000 live births and a maternal mortality rate of 14.3% per 100,000 women giving live birth (MOH, 2007). Sri Lanka is regarded as a success story in achieving the above vital health indicates much earlier than its regional counterparts. Further, most of the key health indicators are almost at the same levels as that of developed countries. In Sri Lanka, both the public and private sectors provide health care. The public sector provides comprehensive health care for nearly 60% of the population under the Ministry of health, free of charge and the private sector provides mainly curative care for an estimated 50% of all ambulatory patients (MOH, 2007). Private health care is largely concentrated in the urban and suburban areas (MOH, 2007). The network of tertiary care institutions ranges from sophisticated teaching hospitals with specialized consultative services to small central dispensaries that only provide outpatient services. There are special service hospitals for the armed forces and the police (MOH, 2007).

The health services in the public sector are characterized by a very busy and overcrowded system of national, provincial, general and base hospitals at the upper level of health care. A wide spread network of district hospitals and peripheral health care units that operate at the primary health care (lower) level in the health care hierarchy, are underutilized and are not accepted by most people. This results in the

overburdening of the secondary and tertiary levels of health care with health problems which could easily be handled at the primary care level. As recommended by the WHO, management of the health care system in Sri Lanka needs to be improved by a clearer basis for coordination of health services, coupled with adequate resource allocation and the strengthening of the existing institutions (WHO, 2008). Improving equitable access to quality services and diverting health problems to the appropriate level of care givers are key concerns of the government's health policies.

Large public sector health facilities experience overcrowded out-patient departments (OPDs), long queues and bed occupancy rates of over 100%. These problems are exacerbated by the lack of a rigid referral system to the higher levels of care from the small community health centers (Caldwell, Gajanayaka, Caldwell, & Pieris, 1989). Therefore, many patients try to seek out-patient treatment at private clinics and health centers. Often patients choose to consult consultants / public sector doctors when they see patients privately, outside the official working hours. There is a marked concentration of hospitals (public and private) in the urban areas and a bias in the distribution of health care facilities in Sri Lanka (Wanasingha, 1995). The costs of health care in the public funded services are generally affordable because health care facilities and medications are provided free of charge to all. The quality and consistency of care in the primary health care institutions need to be enhanced to boost public confidence and prevent the overburdening of the secondary and tertiary health care institutions.

Some of the major health challenges in Sri Lanka are due to a rapid demographic transition to an increase in the aging population. An increased prevalence of non-communicable diseases (NCDs) is a major health challenge for Sri

Lanka (MOH, 2007). A recent cross-sectional descriptive study was conducted by De Silva et al. (2012) among 1234 adults over 35 years old in Kalutara district-Western province in Sri Lanka. Their study findings reported a 14.7% prevalence of diabetes in the more affluent and educated segments of society (De Silva et al., 2012). Therefore, the government has implemented several policy initiatives such as the National Policy and Strategic Framework for Prevention and Control of Chronic Non-communicable Diseases in 2010 (Engelgau, Okamoto, Navarathne, & Gopalan, 2010). The government budget allocation in 2011 approved an additional Rs. 900 million for a three-year action plan to target the control of NCDs and this is now being implemented by improvements to the primary healthcare system of the country (Department of Census and Statistics, 2012).

Similar to other Asian countries, Sri Lanka has multiple types of medical care such as Western, Ayurveda, Unanni, Siddha, and homeopathic medicine (Weerasingha & Fernando, 2011). This allows people to independently seek their choice of medical care. Amongst these types of care, Western medicine and Ayurvedic medicine are the main forms of care (Weerasingha & Fernando, 2011). Traditional medicine is widely practiced with exorcism adding to the costs of health care in many rural and peri-urban families. Modern medicine can be obtained at more convenient sites and at a cheaper cost than traditional health care in Sri Lanka (Caldwell et al., 1989). According to Caldwell et al. (1989) traditional healers frequently refer patients to Western medicine and to hospitals when their treatment modes are not successful, however, the decision to change the form of treatment is often decided by the patient and patient's relatives when one form of treatment is unsuccessful to relieve the disease. Usually the patient adheres to about five days of

care before changing the type of treatment (Caldwell et al., 1989). The rapport and relationship of the patient with healthcare personnel has a significant impact on the patients' health related behavior.

Another factor that affects patients' health-related behaviors is their beliefs and attitudes towards their illness. Some of these may be due to religious reasons, family traditions and influences from friends and family. These aspects have not been quantified and assessed thus need to be essentially addressed amongst the Sri Lankan patients with diabetes. It has been identified that many people living in Colombo (capital of Sri Lanka) were willing to pay for private medical consultations and treatment because they believed that fee paying consultation would build a better relationship with the care-giving doctor than a non-fee paying public hospital clinic (Russell, 2005). Despite the strengths of Sri Lankan public health sector, poor doctor-patient relationships act as a barrier for the adherence to treatment and compliance to medical instructions (Russell, 2005).

Diabetes and the Health System in Sri Lanka

In Sri Lanka, once a person has been diagnosed with T2DM they are clinically assessed by a physician and prescribed antidiabetic medication and other relevant health care advice. Moreover, these patients are advised to continue their follow up care from a DM clinic or medical clinic. The patient has the liberty to select either a public hospital or a private hospital for their diabetic care. The majority of them select a public hospital because it provides free consultations and necessary medications free of charge. All hospitals in Sri Lanka provide outpatient and inpatient care for all patients with diabetes. The majority of the teaching

hospitals (tertiary health centers) have a “diabetic clinic”. The Sri Lanka Medical Association has published guidelines on the management of diabetes mellitus (Fernando & Dewapura, 2000). Apart from the free government hospital facilities, diabetic care is available from the fee paying private health care institutions or from Ayurvedic health care units. Further, a group of health workers and lay persons established the Diabetes Association of Sri Lanka (DASL) in 1984, which is affiliated to the International Diabetes Federation. This Association provides clinic services at nominal cost, health education and conducts research through the National Diabetes Center (NDC) in the Colombo district. NDC was established in 1995 and functions as the head office of the DASL, a nongovernmental organization, which offers clinical services and education for the patients with diabetes.

Assessment of the quality of diabetic care has been studied as an audit in diabetic clinics (Jayawardene et al., 2007). This audit identified standards of diabetic care in the CSTH-DM clinic. Many weaknesses in diabetic care were observed. Some deficiencies noted were that there was no structured education program for patients with DM, lack of facilities for screening the complications of diabetes, or the inadequacy of tests to monitor glycemic control. The only routine test carried out in these clinics was a Benedict’s test for reducing substances in a urine sample provided by the patients on each monthly visit (Jayawardene et al., 2007). The above study revealed that most patients with diabetes complied poorly with diet control and tight glycemic control was observed in about 1/3 of the patients (Jayawardene et al., 2007). The study concluded that the reasons for this suboptimal care to patients with DM were lack of resources for laboratory investigation in the state sector (Jayawardene et al., 2007). The inability to conduct these routine tests such as the HbA1c, urine

micoalbumin and lipid profile greatly hampers optimal diabetic care. Simple clinical assessments such as measurement of the blood pressure and inspection of the feet for injuries and ulcers are not conducted due to overcrowding and lack of health care personnel (Jayawardene et al., 2007). In the routine diabetic clinic at the CSTH there are three non-specialized medical doctors to care for 130 patients within a routine clinic of 4 hours duration. There is a paucity of examination facilities at these clinics as it has only one examination couch which is shared by all the doctors and there is no private examination area (Jayawardene et al., 2007). Finally the study highlighted that these weakness cannot be easily remedied in a developing country like Sri Lanka, but it is feasible to aim for improvements in knowledge, attitudes and skills among both patients with diabetes and the health care providers. As a result of this audit, a number of changes have been implemented in the CSTH-DM clinic, including that the clinic was moved to a new more spacious premises which could accommodate a patient education area. A specialist nurse trained in patient education was allocated to the DM clinic (Idampitiya, Lenora, Lau, Thomson, & Fernando 2008). In terms of knowledge of healthcare personnel, updated knowledge regarding DM management is vital. The knowledge, awareness and practices relating to DM management among 246 general practitioners in Sri Lanka were assessed in a cross-sectional study (Katulanda et al., 2011). The study concluded that the knowledge and skills of the general practitioners were suboptimal and highlighted the need to improve general practitioners knowledge and practices related to DM (Katulanda et al., 2011). In summary, it can be concluded that health care personnel and the health care system in a particular society have a significant influence on glycemic

control among patients with T2DM and the knowledge, skills, attitudes of these personnel should be enhanced.

As mentioned earlier, Sri Lanka is experiencing a high prevalence of diabetes which will increase rapidly in the future. Wijewardane et al. (2005) found that the prevalence rate of diabetes among adults aged between 35 and 65 years in four provinces in Sri Lanka was 14.2% in men and 13.5% in women. Thus each year many new cases of diabetes are diagnosed amongst working people who may be lost to the work force if they developed diabetes-related complications in the future. Katulanda et al. (2008) identified one in five adults in Sri Lanka has either diabetes or pre-diabetes. Another study, conducted on 110 adult diabetic patients in Sri Lanka, found that complications related to diabetes were as follows: 84.5% with neuropathy, 54.5% with associated retinopathy, 37.3% suffered with ischemic heart disease, and 30% had nephropathy (Jinadasa & Jeewantha, 2011). Katulanda, Rathnapala, Sheriff, and Mathews (2011) conducted a study to determine the prevalence of DM among 4532 adults in seven of the nine provinces in Sri Lanka. Results revealed that prevalence of DM (95% CI) in seven provinces as follows: Western (18.6%), Central (12.6%), Southern (12.2%), Sabaragamuwa (11.5%), North-western (10.0%), North-central (9.6%), and Uva (6.8%). Further, compared to other provinces there is a high prevalence of DM in the Western province with the lowest level of physical activity (2721 Met-minutes), high BMI (23.6 kg/m^2) and high waist circumference (83.3 cm) than the other provinces (Katulanda et al., 2011). Recently, De Silva et al. (2012) reported that 14.7% prevalence of diabetes among 1234 adults over 35 years age in Kalutara district-Western province in Sri Lanka. The DM clinic in Colombo South Teaching Hospital (CSTH) (a tertiary care hospital situated in the Colombo district

under the Western province) provided care for around 32,341 adult patients with diabetes during the first 6 months of the year 2010 (CSTH, 2010). In addition, the number of complications related to DM is increasing and in turn the health care cost is also increasing greatly. Thus it becomes a challenge to care for adults with T2DM in Sri Lanka.

Owing to the present national peak in diabetes, many attempts have been made to establish control of blood glucose among patients with diabetes in Sri Lanka. In line with these activities recently, the Medical Faculty of the University of Colombo started the Diabetes Research and Prevention Unit in 2005, to conduct multi-disciplinary research in diabetes, metabolic disease and cardiovascular disease. This research will ultimately help to develop strategies for primary prevention of diabetes and better clinical care. The World Diabetes Foundation funded project, The National Initiatives to Reinforce and Organize General Diabetes care in Sri Lanka (NIROGI Lanka), has been started to improve quality and delivery of preventive care and care services for patients with DM. Educating and training health care personnel on diabetes management is another important activity under the above project (Nirogi Lanka, 2009). There have been awareness programs on promoting to prevent diabetes such as an awareness campaigns, and Diabetes Day. Fortunately diabetic issues, prevention and control of sugar and salt are often discussed in the newspapers in Sri Lanka (Alahakoon, 2012). As an example, on November 14th which is World's Diabetes Day, a complete page in the Sri Lankan newspaper was dedicated to diabetes and the activities (Awareness campaign for Diabetes Day-2011, 2011). The government is also trying to increase the availability and affordability of vegetables and fruits for daily consumptions than on the past and constructing places for physical

activities in public places to help combat this devastating disease. However, despite these attempts made to minimize the burden of diabetes in Sri Lanka, there are still high mortality and morbidity rates among people with diabetes.

Traditional Health Behaviors in Sri Lanka

In Sri Lanka people have many traditional health behaviors. According to the Sri Lankan cultural and traditional beliefs, alternative modes of treatment such as Ayurveda, homeopathy and acupuncture and spiritual healing methods either alone or in combination are used by a large number of people (Senevirathne, Rajapaksha, Pathirna, & Seetha, 2002). Pieris (1999) undertook two studies to review the evolution of Sri Lanka's health care system from the traditional to the modern, finding that when people think the cause of the disease is supernatural, it is treated by ritual or magico-religious types of cures (Pieris, 1999). Commonly practiced rituals and magico-religious behaviors towards illness in Sri Lanka are exorcism, yantra, mantra, charmed string, oil, water, cutting limes, bodhi puja (offering at a Buddhist temple), making vows promising to give alms, (objects or even money), services by a priest, visiting palm readers, and burning spice mixtures (Pieris, 1999). Further Peiris (1999) mentioned that it is hard to separate supernatural healing from traditional healing to the people in Sri Lanka. Western and supernatural health systems are used simultaneously until it is recognized whether or not the treatment achieves results, namely a return to good health and wellbeing. However, most of the Sri Lankan population believes they can get some kind of relief from religious activities parallel to their treatment with Western medicine (Pieris, 1999).

The Sri Lankan unique sociocultural context may affect diet control behavior among adults with T2DM. Rice and curry are the main staple foods for main three meals and eating a heap portion of rice is the normal dietary pattern. Further, the main beverage is a cup of tea with sugar. At any time, on any given occasion, offering a cup of tea with sugar (either with milk or without milk) is the symbol of hospitality in Sri Lankan culture. Further, majority of people eat a large heap of polished white rice with two or three small portions of curry (often vegetables cooked in coconut milk) for their main meal. According to the traditional cooking pattern the majority of Sri Lankan curries are prepared with coconut oil and coconut milk. These contain high saturated fat content and perhaps can influence glycemic control among adults with T2DM. According to Jarvi et al. (1999) low glycemic diets are beneficial in both type 1 and type 2 diabetes. Even though some basic Sri Lankan food have a high glycemic index, once they are prepared as a rice mixed meal, it has a reduced the glycemic response (Hettiarachi, Ekanayaka, & Welihinda, 2009).

Normally, Sri Lankan food practices include the use of additives such as salt, oil, sugar, and eating food without these additives may be difficult for Sri Lankan adults with T2DM. Patients with T2DM have been advised to have low salt, low sugar, and low fat diet. In addition, preference for specific food types (such as eating more rice, curries prepared with coconut milk, tea with sugar) when steeped in family traditions and passed down through generations may be strongly resistant to change even though adults with T2DM know the food is bad for their health. Hence, if health care personnel advise patients with T2DM to reduce the volume of rice and to avoid the consumption of sugar in order to control their glycemic levels. This may not be easy for them as smaller portion size may cause dissatisfaction, discomfort and

hunger. In their normal day-to-day life, and may reduce their quality of life. According to Jayawardena, Byrne, Soares, Katulanda, and Hills (2012) in a cross-sectional study about food consumption among 600 adults in Sri Lanka, a substantial proportion adults failed to achieve a recommended balanced diet due to eating less amount of fruits and vegetables, and eating a high amount of starch and sugar. The research team concluded that a nutrition-related disease such as in the country may be closely correlated with this unbalanced eating habits (Jayawardene et al., 2012).

With regard to food practices, Jayawardene, Byrne, Soares, Katulanda, & Hills (2012) in a recent review reported several dietary factors associated with insulin resistance among South Asians. A high intake of carbohydrate, saturated fatty acids, trans-fatty acids and n-6 PUFA, and low intakes of n-3 PUFA and fiber, in the Asian diet may be important contributory factor, for the high disease prevalence.

Regarding the influence of education status influences on dietary behavior, even though there is high literacy rate in Sri Lanka, there is not much evident when related to the impact of educational level among patients with T2DM, including knowledge related to diabetes. It can be assumed that adults with T2DM who have higher educational level may seek more information related to their disease than the poorly educated people with T2DM, and in turn have good glycemic control. In terms of economic status influencing dietary behaviors, fresh vegetables, fruits and low index glycemic food are wieldy available in Sri Lanka for a reasonable price, but the majority of people in the middle income level may have difficulties buying those food.

Family and social relationships as one aspect of social context which may influence dietary behaviors need prior explanation in Sri Lanka. In Sri Lanka there

are many ethnic groups and in all of these, the most important social unit is the nuclear family: husband, wife, and unmarried children. Even when economic need causes several families or generations to live together, the wife will maintain her own cooking place and prepare food for her own husband as a sign of the individuality of a nuclear family. The kindred (pavula, in Sinhala language) of an individual often constitute the people with whom it is possible to eat a meal together. Furthermore, preparing the meals for the whole family members and eating together is a main family custom among Sri Lankan families. The preparing of the aforementioned diabetic meal for an individual family member with T2DM may not be an easy task. Basically a wife is responsible for preparing the meal, so she has to prepare two meals separately (one meal for family members and the other for a family member who diagnosed with DM) which is time consuming, cost consuming, additional work and may disturb the family relationships. This may be the same situation for family-social gathering as well. Thus in reality due to a greater influence for looking after family relationships, people with T2DM will eat what is put in front of them, when at the homes of other family members even if the food is bad for their physical health.

Among Sri Lankan population, doing exercise may be grounded with doing some sport. Average Sri Lankans do not consider physical activity as an important aspect of health and well being. The same disinterest is observed among adults with T2DM. This is because many adults have a number of family responsibilities in their daily life which account for being physically active; they may not be interested in extra physical activities/exercise. There is not much evidence on physical activities/exercise among adults with DM but some studies with adults also indicated physical inactivity among Sri Lankan adults. Arembepola, Allender, Ekanayaka, and

Fernando (2008) conducted a study to identify the relationship of demographic, socio-economic and lifestyle characteristics with obesity among 770 adults who live in Colombo. They found that physical inactivity had a significant association with high BMI among women and eating out. A high intake of alcohol relate with high BMI among men. High BMI and consumption of alcohol negatively influence glycemic control (ADA, 2012). To support these findings, Katulanda et al. (2011) conducted a study to determine the prevalence and correlates of DM among 4532 adults in Sri Lanka. The researchers found that physical inactivity, high BMI and high waist circumference (2721 Met-minutes, 23.6 kg/m2, and 83.3cm respectively) among adults living in the Western province (Katulanda et al., 2011). At present the availability of facilities to do exercise such as walking paths and, cycling tracks and use of these provided facilities is still not so popular among the general population. In general, most Sri Lankans are not much aware of doing physical activities/exercise because as mentioned earlier they already engage in heavy duty manual jobs (e.g. farmers, fisher men, garment workers). Currently in Sri Lanka there are some centers for exercise but these centers charge fees for the use of resources.

Adherence to medication regime is another glycemic control behavior which may be influenced by the socio-cultural context in Sri Lanka. Recently, Illangesekara (2011) found that there are some misconceptions such as “insulin is not a treatment because they believed it may negatively affect their glycemic control” among adults with DM in Sri Lanka (Illangesekara, 2011). Moreover, Weerasingha and Fernando (2011) investigated treatment seeking behaviors among adults living in Sri Lanka, and concluded there was a strong belief among participants that Western medicines have “strong effects” that could harm the body, whereas traditional

medicines have a “cooling effect”. The later lead them to stop taking Western medicine among some of their participants. As there are not many studies available on educational level and the illness in Sri Lanka, in general higher educational level influence the adherence to medication behavior because they are aware of the consequences of non-adherence. Due to free health in the public sector patients with T2DM do not need to pay for their medication, but those who seek care from the private sector and Ayurveda care have to pay for the medication and consultation. This can influence medication adherence. The existing high family relationships in the Sri Lankan socio-context may influence medication adherence behavior by a family member remembering the time and the type of the medication, helping to take the medication and even financial and other support to buy the medications.

In summary, based on the above mentioned literature, social cultural context influences, diet control, physical activity/exercise, medication adherence and behaviors which are highly recommended to control glycemic levels among adults with T2DM. Currently Sri Lanka is experiencing a high prevalence of diabetes and its related complications which is an added burden to the country. However, there is limited evidence about how sociocultural factors impact on glycemic control behaviors among adults with T2DM in the Sri Lankan context. This kind of study will lead to gaining holistic understanding of the glycemic control among adults with T2DM in Sri Lanka.

Naturalistic Inquiry and Glycemic Control Behaviors

Some theories which discuss the impact of culture on human behaviors, the majority of them are developed within the Western culture. Hence it is difficult to use as a guide for the study in a South-Asian culture like Sri Lanka. However, this is not the case with naturalistic inquiry, which is the philosophical underpinning of this study guiding the researcher to explore glycemic control behaviors among adults with T2DM in Sri Lanka. According to Guba and Lincoln (1982) in naturalistic inquiry the reality is captured in the form of multiple, intangible mental constructions and thus supports ontology. This reality is viewed as pluralistic, meaning that within any research study there will always be many different interpretations that can be made (Guba & Lincoln, 1982). This reality has no universal or timeless validity but is valid for the age in which the social group or individual person holds the reality (Denzin & Lincoln, 1994). Generally, a phenomenon studied in the social or behavioral sciences has no reality in a tangible sense. This means the phenomena we study cannot be touched, smelt, seen, heard or tasted. Nevertheless, researchers care about these tangibles and the meaning and interpretation that people attribute to make these tangibles or constructions mediate their behaviors (Guba & Lincoln, 1982). Filestead (1979) described reality as "multiple realties and individuals are conceptualized as active agents in constructing and making sense of the realities that they encounter" (p. 36). Thus, there are as many constructions as there are people to make them. In terms of the inquirer/respondent relationship (epistemology), the naturalistic inquirer and the "object" of inquiry interact to influence one another; and especially this mutual interaction is present when the object of inquiry is another human being

(respondent) (Lincoln & Guba 1985). This is because in human inquiry, the respondent may react to the inquirer or to their inquiry methods so it is impossible to make a discrete distance between the inquirer and the respondent. The inquirer may shape the respondent's behaviors and the respondent shape the inquirer behaviors. Therefore, special safeguards must be taken against both kinds of reactivity (Guba & Lincoln, 1982). With regard to the nature of the truth statements, the aim of inquiry in naturalistic paradigm is to develop an idiographic body of knowledge. Furthermore, in naturalistic inquiry, attribution/explanation of action may be explainable in terms of multiple interacting factors, events, and processes that shape it and are part of it; inquirers can, at best, establish plausible inferences about the patterns and webs of such shaping in any given case (Lincoln & Guba, 1985). Further, they described that the best method for assessing these patterns and webs is the field study that deals with them holistically and in their natural contexts.

According to Guba and Lincoln (1982) in naturalistic inquiry, realities are constructed and exist only in the minds of people. Thus the causality for these realities heavily depends on the given meaning and this causality is less appreciable by empirical linkages (Lincoln & Guba, 1985). The concepts of constructed reality and constructed causality are agreeable to and supportive of one another (Guba & Lincoln, 1982). Thus human actions can be understood not as having been caused but as having emerged from the constant interplay of its shapers, all of which are themselves part of the action, indistinguishable from it and shaping and being shaped simultaneously (Guba & Lincoln, 1982). In terms of values to inquiry, a phenomenon is always value bound (Guba & Lincoln, 1982). Naturalistic inquirer acknowledges the role that values play in shaping an inquiry and appreciates the possibility of the

difficulties that may arise. Those values should not characterize individuals, but are specifically focused on characterizing social, behavioral, human and organizational phenomena (Lincoln & Guba, 1985).

As mentioned above glycemic control behaviors are highly individualized and depend on the particular culture. It is doubtful to believe a single universal truth which was found without a relationship between the knower and the known. Therefore, the author believes that there may be multiple views of reality existing as individual experiences of glycemic control behaviors and they could be found from the interaction between the researcher and the participant throughout using the ethnographic approach. As naturalistic ontology suggests that realities are not wholes which cannot be understood in isolation from their contexts, nor can they be separated for single study of the parts hence the ethnographic approach was conducted in the natural setting in this study. Additionally, the researcher believes that participant observation will influence what is seen, and thus the researcher interaction should take place with the participants in context for better understanding of the phenomena based on participants' views of the glycemic control behaviors. Moreover, as the researcher is the instrument in the ethnographic approach it is up to them to catch the meaning of a particular event.

In summary, the naturalistic approach guided the researcher to recognize how the participants' own background shaped their interpretations. Further, it helped the researcher to recognize her position in the research and to acknowledge how the participants' interpretations flowed from their personal and cultural experiences.

Ethnographic Approach as a Research Methodology

"Ethnos", a Greek term, denotes a people, a race or cultural group (Smith, 1989, as cited in Denzin & Lincoln, 1994) and combined with the term "graphic", the term "ethnographic" refers to the science of describing ways of life of humankind (Denzin & Lincoln, 1994). Ethnography has been described by many authors in different ways. For example Spradley (1979) said it is the work of describing a culture and the core of this is activity intended to understand another way of life from the native point of view. Fetterman (1998) added more by describing ethnography as the art and science of describing a cultural group and the focus of inquiry is to identify the predictable patterns of human thoughts and behavior. In 2009 Creswell, stated that ethnography is a methodology of inquiring in which the researcher studies the whole cultural group in a natural setting over a long period by collecting, primarily observational and interview data (Creswell, 2009).

Many nurse scholars also described ethnography. For example, Field and Morse (1985) identified the ethnographic approach as a naturalistic research method which aimed to understand human behavior and attitudes through participant observation and informant inquiry. Omery (1988) described ethnography as the disciplined study of what the world is like to the people who have always lived in that world. According to Spradley (1980) ethnography is a work of describing culture and this work must be guided by the strong desire to understand other individuals' lives. With considering all these explanations, it can be concluded that ethnography is a method of studying culture and how individuals experienced their culture.

In terms of the history of ethnography, Sanday (1983, as cited in Streubert & Carpenter, 2011) indicates that ethnography began with Herodotus. More recently others indicated that in 1922 Malinowski's anthropological study of the Trobriand Islanders was the beginning of ethnography. Many texts highlighted that Boas, Malinowski, and Radcliffe-Brown, the founders of modern ethnography, were committed to ethnography as a science. With regard to the types of ethnographic approach, Muecke (1994, as cited in Streubert & Carpenter, 2011) mentioned there are four major ethnographic schools of thoughts: classical, systematic, interpretive and critical. Classical ethnography includes a description of behavior and mostly describes everything about culture (Morse & Field, 1995). Systematic ethnography is used to study the structure of culture than describing the people and their social interactions, while interpretive/hermeneutic ethnography studies the meanings of observed social interactions; and critical ethnography relies on critical theory focus on members of a culture to create a culture schema (Muecke, 1994, as cited in Streubert & Carpenter, 2011). In addition to these four schools of thoughts, a nursing anthropologist described a specific approach called "ethno nursing" which allows nurses to study nursing phenomena from cross-cultural perspectives (Leninger, 1985).

Characteristics of Ethnography

For the better understanding the ethnographic approach, it is worthwhile to consider the characteristics of ethnography. In the nursing field, Streubert and Carpenter (2011) stated that fundamental characteristics of ethnography were the researcher as the instrument, focus on the culture, cultural immersion, reflexivity, fieldwork, and. cyclic nature of data collection and analysis,

Researcher as instrument. An interesting feature in the ethnographic approach is that the researcher works as the instrument. This means, in order to collect data, the researcher participates in the events of the cultural group and with the help of cultural informants, and looks for connections, patterns, themes or relationships that have meaning for the people in it (Streubert & Carpenter, 2011). When the ethnographer works as the instrument the etic and emic perspectives are really important (Streubert & Carpenter, 2011). Etic refers to outsider or stranger's perspective of a culture, while "emic" is used to refer to the "insider or local viewpoints" (Denzin & Lincoln, 1994; Fetterman, 1998; Streubert & Carpenter, 2011). Emic data are inductively or empirically derived from first hand interviews, observations and direct participant. This emic or insiders' perspective is at the heart of most ethnographic studies. When ethnographers see culture as a mental or ideational system, they generally assume that it can be described only by "getting into the head" of the participants studied (Spardley, 1979). This participant's inside view of reality is instrumental to understanding and correctly describing the particular behaviors (Fetterman, 1998). This means that participants' inside views help the ethnographer to understand why the participant does or does not do. Diverse perceptions of this reality can be an important indication of individual beliefs, customs, religious, ethnicity and socio-economic status. Thus the researcher can understand the reason for their behaviors. On the other hand etic is an external and more general view which may be based on the researcher's observations and interpretations of data (Spradley, 1979). The strength of the participant observation is the opportunity to access information from the etic view.

Focus on the culture. Culture it is the broadest ethnographic concept. Streubert and Carpenter (2011) state that ethnography is the only research method whose exclusive purpose is to understand the life ways of individuals connected through group membership which broadly means the culture. In the ethnographic studies the definition of culture is based on either a materialistic interpretation or ideational perspective (Fetterman, 1998). The materialistic interpretation of culture focuses on behavior like the collection of a social group's observational patterns of behavior, customs and way of life (Harris, 1968, as cited in Streubert & Carpenter, 2011) whereas in the ideational perspective, the definition of culture is based on cognition like ideas, beliefs and knowledge that characterize a particular group of people (Fetterman, 1998). This ideational perspective is more popular in ethnographic studies. Obviously ethnographers want to know about both cultural behaviors and knowledge to describe human behaviors adequately. The interpretation of a particular culture rests on carefully collected ethnographic data.

Cultural immersion. To collect data the ethnographer participates in-depth and for a length of time in a particular culture by living among the people being studied. This type of ethnographer participation is named as "cultural immersion" and is an unique characteristic of ethnography (Streubert & Carpenter, 2011). Furthermore based on the interviews, observations, participation in the culture and review of cultural artifacts, the ethnographer interprets and draws conclusions about the culture based on his/her discoveries while collecting data.

Reflexivity. This is another unique characteristic of ethnography, and is described as the struggle between being the researcher and becoming the member of the culture. Streubert and Carpenter (2011) described that this reflexivity is important

to the ethnographer to remain close to the research objectives and stay focused on the research. Furthermore, through this type of participation, the researcher comes to realize that they alter the culture and have the potential to lose their objectivity more than in the typical conduct of a research (Streubert & Carpenter, 2011). The reason for this is due to prolonged involvement as a researcher and participant in a group. It is extremely difficult to maintain having a fully detached view. In summary, the above mentioned main unique concepts or characteristics help to explain what ethnography is all about and to guide an ethnographer in the pursuit of the study.

Methods and Techniques in Ethnography

In ethnography there are several data collection methods such as participant observation, in-depth interviews, focus group discussion, use of written narratives, documentary analysis, and using field notes. Participant observation, in-depth interviews and focus group discussion are the most essential data collection methods. Most of these methods are used in the field.

Field work. Ethnographic studies usually take place in a natural setting and an interesting characteristic of this methodology is that the researcher tries to become a member of the culture being studied (Leninger, 1985). Being in the field helps the researcher to better understand the culture of the people studied. Therefore, an extensive period of fieldwork and the essential methods of participant observation and informal/formal interviewing enable the researcher to learn from people the meaning of their behaviors including their beliefs, behaviors, customs, attitudes and knowledge.

Cyclic nature of data collection and analysis. Data is collected in the field by the researcher to describe the differences and similarities. The collected data lead to other questions about the particular culture. Further answering these questions lead to more questions. Therefore, in ethnography the researcher engages in a continuous process of interviewing, observing reviewing materials, analyzing those data, and returning to the field to do more interviews, conduct more observations and collect additional artifacts (Streubert & Carpenter, 2011).

Participant observation. Many researchers described participant observation as a data collection method of studying people in their natural environment. Gaining depth of insight into behavior does not come simply from close, detailed observation but also from the researcher's own experiences within the group being studied (Morse & Field, 1995: Spradley, 1979). The goal of participant observation is to discover discrepancies between what participants say and what participant do (Spradley, 1979). During this method the researcher collects the data systematically, but unobtrusively using the field notes. These represent the participant observer's efforts to record information, to synthesize and understand the data. Spradley (1979) mentioned field notes are an attempt to provide a literal account of what happened in the field setting, social processes and their content. Unfortunately, to date there is not enough evidence about the use of the participant observation method in diabetes-related glycemic control behaviors. In this study the researcher observed how the participants engage in their glycemic control behaviors in their daily life with informal conversations, by observing their cooking patterns, dietary behaviors, physical activity or doing exercise and medication taking behavior.

In-depth interviews. This is a form of a conversation in which the researcher probes deeply to uncover clues, to open up new dimensions of a problem (Seidman, 2006). Streubert and Carpenter (2011) defined the in-depth interview a formal qualitative interview and unstructured conversation with a purpose that usually features audio taped and verbatim transcription of data; it uses an interview guide rather than a rigid schedule of questions and open-ended questions in in-depth interviews provide participants with the opportunity for greater freedom in the answers provided (Streubert & Carpenter, 2011). In general, the purpose of qualitative in-depth interviews is to understand the meaning of the experience for those who are part of it. The interviewer wants to know how and why they experienced certain events in their lives as they did. Understanding their emotional reactions to events is also possible in in-depth interviews. There are many advantages and disadvantages to in-depth interviews. Advantages are they allow time for a participant, in peace, to further develop and give reasons for his or her individual point of view without being influenced by the opinions of other respondents, complex issues can be probed, answers clarified, and sensitive information obtained (Seidman, 2006). As an example, Early et al. (2009) conducted in-depth interviews among 18 patients with T2DM to find their diabetic dietary goals and self-management practices, and found influencing factors, motivators and barriers to dietary modifications for diabetes management. Disadvantages are the data is voluminous, time consuming to gather and difficult to analyze. In-depth interviews were conducted in this study with adults with T2DM, their family members, doctors and Ayurveda practitioners/traditional healers.

Focus group discussions. These are a special type of group interview because of purpose, size, compositions and procedures. Participants are purposively selected because they have certain common characteristics which are related to the topic of the focus group (Morgan, 1993). Focus groups are designed to explore participants' perceptions, attitudes, and ideas about a given issue or experience and allows the researcher to examine the points of view of participants as they share their concerns and opinions. The underpinning assumption of this method is that individuals are valuable sources of information and are capable of expressing their own feelings and behaviors (Clarke, 1993). A qualitative study conducted among 38 patients with T2DM by using seven focus groups found that time consumption, lack of self-control, pain and memory failures were barriers to self-care (Chlebowy et al., 2010). Moreover, focus group interviews yield more accurate information about what participants actually think and do other than the other research methods. Often patients with T2DM agree to adhere to self-care with their health care professionals. Focus group interviews found a number of barriers to adhere (Chlebowy et al., 2010: Lawton et al., 2008). In focus groups there are advantages as well as disadvantages. Some of the advantages are that they are inexpensive, flexible, stimulating, cumulative and elaborative, assisting in information recall and are capable of producing rich data. A major disadvantage occurs when a stronger member of a group has major control over the verbalization of other group members. However, a good leader/moderator can overcome the tendency of domination in the group if the moderator is attentive to its potential throughout data collection (Streubert & Carpenter, 2011).

Justification to Use an Ethnographic Approach in This Study

As highlighted earlier, the use of ethnographic approach allows nurse scientists, to capture the complexity of human responses to the health, and illness. It is consistent with the nursing professions practice that is complex, holistic and embraces the total human experience. Nursing is faced with challenges in caring for patients with diabetes because complications related to diabetes are highly reliant on patients' glycemic control behaviors. Nurses have to educate them about these behaviors and empower them with necessary behavioral changes. However, as mentioned in Chapter 1, there is limited knowledge regarding glycemic control behaviors among adults with T2DM in Sri Lanka. This limited knowledge reveals the necessity of conducting ethnographic research to obtain information on cultural beliefs, attitudes and norms, which help to understand how glycemic control is perceived and received by members of different cultural communities in a much ethnic country like in Sri Lanka.

Moreover, in previous studies related to glycemic control behaviors among adults with T2DM used quantitative designs with either prospective or retrospective data. However, many individual factors influence glycemic control behaviors. Thus, it is unlikely that in-depth reasons for practicing of glycemic control behaviors can be captured by using questionnaires with closed or open ended questions. Additionally, though a number of instruments have been developed to survey these behaviors, the use of them may be difficult in cross-cultural contexts as they are developed by foreign researchers.

Furthermore, using an ethnographic approach to explore glycemic control behaviors among adults with T2DM in Sri Lanka, allows the development of fuller understanding of the specific and cultural context that structure glycemic control behaviors. The increasing number of people with diabetes in different cultural groups makes it necessary to develop a cross-cultural understanding of diabetes management. Therefore, the researcher believes ethnography is the most appropriate methodology to fill the proposed gap of knowledge. Its data collection methods would give a holistic understanding of the phenomena under study.

Adherence to glycemic control behavior among adults with T2DM in Sri Lanka is not known. On the other hand, behaviors such as dietary practices, food choices, eating patterns, exercise, care seeking, and use of medication are highly culturally-bound activities. Thus, this ethnographic study included participant observation and in-depth interviews, enabling exploration of the existence of these culture-bound different practices (alternative realties). An ethnographic study using the rich description of culture would help to discover the phenomena which were indigenous to the culture.

The researcher believes that ethnography is suitable to understand health related behaviors in non-western cultures. Sri Lanka is a non-western country with unique cultural characteristics such as deep religious orientation, reliance on the extended family, defined gender roles, stronger gender taboos, use of the Sinhala language, and adherence to traditional beliefs and practices. Therefore, what is perceived as glycemic control behaviors in Western countries may be irrational for a Sri Lankan adult with T2DM. Cultural uniqueness impacts on health behaviors of adults with T2DM. Such understanding becomes particularly important for nurses

and other health care personnel to understand the adult T2DM patients' glycemic control behaviors, in turn to deliver culturally appropriate health care.