

CHAPTER 4

Current Situation of Glycemic Control Among Adults with T2DM

This chapter describes the current situation of glycemic control among adults with T2DM in three main sections: glycemic control among adults with T2DM; factors related to glycemic control among adults with T2DM; and perceptions regarding glycemic control as perceived by health care personnel and adults with T2DM. The chapter concludes with discussion of findings.

Glycemic Control Among Adults with T2DM

Information related to glycemic control was obtained from adults with T2DM by using the Diabetes Information Form (DIF). The results are presented as follows: demographic characteristics, illness related characteristics, glycemic control, and glycemic control behavior among adults with T2DM.

Demographic Characteristics of Adults with T2DM

Table 4-1 shows there were more female participants (63.5%) than males (36.5%). The age of participants ranged from 23 to 89 years of age with a mean of 54.11 years (SD = 10.97). The highest number of participants belonged in the age group 50 to 59 years (36.1%). The majority were married (95.2%), belonged to the Sinhalese ethnic group (87.0%) and practiced Buddhism (82.6%). Approximately one third were educated up to grade 10 (O/L) (38.2%) whilst 33.5% were educated up to

grade 5 to grade 9. Regarding occupational status, 32.1% of subjects were housewives. Skilled manual workers and unskilled manual workers each comprised of 16.5% of the sample. The average monthly household income ranged from 5000 to 21,000 Sri Lankan rupees per month with a monthly mean income of 15630 Sri Lankan rupees (SD= 5.84) and 29.6% of participants received a monthly income over 20,000 Sri Lankan rupees and above.

Table 4-1

Demographic Characteristics of Adults with T2DM (n=230)

Demographic characteristics	Number (%)
Gender	
Female	146 (63.5)
Male	84 (36.5)
Age (years)	
20-29	4 (1.7)
30-39	19 (8.3)
40-49	52 (22.6)
50-59	83 (36.1)
60-69	61 (26.5)
≥ 70	11 (4.8)
Range = 23- 89 years	
\bar{X} (SD) = 54.11 (10.97)	
Marital status	
Married	219 (95.2)
Unmarried	11 (4.8)
Ethnicity	
Sinhala	200 (87.0)
Tamil	19 (8.3)
Muslim	11 (4.7)

Table 4-1 (continued)

Demographic characteristics	Number (%)
Religious practice	
Buddhist	190 (82.6)
Hindu	15 (6.5)
Catholic	14 (6.1)
Islamic	11 (4.8)
Educational status	
not attend school	6 (2.6)
below grade 5	8 (3.5)
grade 5-grade 9	77 (33.5)
up to Ordinary level (O/L)	88 (38.2)
up to Advanced level(A/L)	46 (20.0)
Diploma	5 (2.2)
Occupational level	
Professional	6 (4.3)
Technical & Clerical	5 (2.2)
Venders & Sellers	26 (11.1)
Skilled manual workers	38 (16.5)
Unskilled manual workers	38 (16.5)
Retired	29 (12.2)
Unemployed	14 (5.1)
House wife	74 (32.1)
Average monthly household income (Sri Lankan Rupees)	
< 5000	29 (12.6)
5000-10,000	47 (20.4)
10,001-15,000	32 (13.9)
15,001-20,000	54 (23.5)
> 20,000	68 (29.6)
Range = 5000 – 21,000	
\bar{X} (SD) = 15630 (5.84)	

Illness Related Characteristics Among Adults with T2DM

Table 4-2 presents the family history of having diabetes was equal (50.0%) among participants. More than half (58.7%) were within 6 months to one year of diagnosis and most (83.9%) controlled their blood glucose levels by using oral hypoglycemic agents. Nearly half (48.3%) were in the normal BMI category.

Table 4-2

Illness Related Characteristics Among Adults with T2DM (n=230)

Illness related characteristics	Numbers (%)
Family history of diabetes	
without family history	115 (50.0)
with family history	115 (50.0)
Time duration since diagnosis with T2DM	
Six months to five years	135 (58.7)
Five years to ten years	32 (13.9)
Ten years and above	63 (27.4)
Modes of diabetic treatment	
Do not use oral hypoglycemic agents or insulin	21 (9.1)
Oral hypoglycemic agents only	193 (83.9)
Oral hypoglycemic agents+ insulin	5 (2.2)
Insulin only	11 (4.8)
BMI category	
Normal weight	111 (48.3)
Overweight	87 (37.8)
Obese	32 (13.9)

Glycemic Control Among Adults with T2DM

The results from the Table 4-3 presents that the blood glucose ranged from 64 mg/dl to 408 mg/dl with the mean of 175.17 (SD = 69.90). Of these, 71.3% of them had FBS level more than 126 mg/dl and 57.0% participants had PPBS level more than 200 mg/dl.

Table 4-3

Blood Glucose Levels Among Adults with T2DM (n=230)

Glycemic control	Number (%)
Fasting blood glucose (FBS)	
≤ 126 mg/dl	66 (28.7)
> 126 mg/dl	164 (71.3)
Range = 64 - 408	
\bar{X} (SD) = 175.17 (69.90)	
Post -prandial blood glucose (PPBS)	
≤ 200 mg/dl	99 (43.0)
> 200 mg/dl	131 (57.0)
Range = 58-765	
\bar{X} (SD) = 230.10 (101.90)	

Glycemic Control Behaviors Among Adults with T2DM

Table 4-4 presents that 71.7% of the participants practiced some dietary control. Eating red rice/brown rice for their three meals is the commonest practice (53.0%), followed by eating two snacks per day (31.8%), and eating larger or more portions of vegetables and fruits (15.2%). Regarding exercise, majority (85.2%) did not practice any kind of exercise, while a smaller percentage exercised regularly or

occasionally. Of participants who exercised, walking was the popular type. With regard to medication adherence, above three quarters of participants (76.5%) adhered to regular medication.

Table 4-4

Glycemic Control Behaviors Among Adults with T2DM (n=230)

Glycemic control behavior	Numbers (%)
Dietary control	
No	65 (28.3)
Yes	165 (71.7)
Daily dietary intake	
Eat red/brown rice for three meals	150 (53.0)
Eat two snacks per day	90 (31.8)
Eat vegetables/fruits regularly	43 (15.2)
Exercise	
No	196 (85.2)
Occasionally	18 (7.8)
Regularly	16 (7.0)
Type of exercise	
Walking	30 (88.3)
Cycling	4 (11.7)
Adherence to regular medication	
No	54 (23.5)
Yes	176 (76.5)

Table 4-5 describes the participants' reasons for not practicing glycemic control behavior. Regarding not doing diet control, 38.4% of those who did not practice diet control mentioned it is difficult to do in their busy lives: and 32.3% had to eat what their family likes to eat. Regarding not exercising regularly, over half (61.7%) mentioned that they have no time in their busy lives. With regard to not taking medication regularly, 37.0% of them mentioned that they cannot take medicine regularly, and 29.6% missed clinics and had misplaced their doctor's prescription.

Table 4-5

Reasons for Not Practicing Glycemic Control Behavior

Reasons	Numbers (%)
Not doing diet control	
Difficult to do it with the busy life	35 (53.8)
Have to eat what my family like to eat	21 (32.3)
Ignore	9 (13.8)
Not exercising regularly	
No time with busy life	121 (61.7)
Having other disorders	34 (17.3)
Doing household work is enough as exercise	21 (10.7)
Not interested	11 (5.6)
Unaware of need for exercise	9 (4.7)
Not taking medicine regularly	
Missed clinics and misplaced doctor's prescription	16 (29.6)
Cannot take medicine with busy life	20 (37.0)
Take medicine when feel sick	14 (25.9)
Do not care	4 (7.5)

As shown in Table 4-6, Chi-square test was used to compare the difference between the glycemic control behavior and glycemic control among adults with T2DM. There was a statistically significant association between medication taking behavior and glycemic control ($P < .05$).

Table 4-6
Glycemic control among adults with T2DM categorized by glycemic control behavior (n=230)

Behaviors	Glycemic control		χ^2	P-value
	Controlled	Uncontrolled		
Diet control				
Yes	50 (30.3%)	115 (69.7%)	.737	.391
No	16 (24.6%)	49 (75.4%)		
Exercise				
Yes	9 (26.4%)	25 (73.6%)	2.56	.277
No	57 (29.0%)	139 (71%)		
Taking medication regularly				
Yes	58 (32.9%)	118 (67.1%)	6.64	.010*
No	9 (16.3%)	45 (83.7%)		

* $P > .05$

Factors Related To Glycemic Control Among Adults with T2DM

Chi-square test was used to compare the association between the factors and glycemic control as shown in Table 4-7. There was a statistically significant difference between age and glycemic control ($p < .05$). Though there were no significant differences between glycemic control and gender, educational status and BMI ($p > .05$), there were high percentages of participants with uncontrolled glycemic levels in each group.

Table 4-7
Glycemic Control Among Adults with T2DM Categorized by Factors (n=230)

Factors	Glycemic control		χ^2	P-value
	Controlled	Uncontrolled		
Age (years)				
≤ 55	27(22.7%)	92(77.3%)	4.37	.037*
> 55	39(35.1%)	72(64.9%)		
Gender				
Female	41(28.0%)	105(72.0%)	.074	.786
Male	25(39.0%)	59(61.0%)		
Educational status				
\leq grade10	51(29.1%)	124(70.9%)	.072	.789
$>$ grade10	15(27.2%)	40(72.8%)		
BMI (kg/m ²)				
≤ 23.0	17(24.63%)	52(75.3%)	.793	.373
> 23.0	49(30.4%)	112(69.6%)		

* $P > .05$

In conclusion, two third of adults with T2DM could not achieve adequate glycemic control. Some had practiced glycemic control behavior such as diet control and medication adherence, but most of them did not practice any kind of exercise. Therefore, to elicit in-depth information about barriers to glycemic control, reasons for adequate glycemic control, and suggestions to improve glycemic control, in-depth interviews were conducted among adults with T2DM. Additionally perspectives regarding these barriers, reasons, and suggestions among health care personnel who provided care for adults with T2DM were also collected via focus group discussions and in-depth interviews. Health care personnel working in a variety of settings such as medical/surgical wards, diabetic clinics, and outpatient departments and able to provide a rich and diverse account of glycemic control were the participants.

Perceptions Regarding Glycemic Control as Perceived by Health Care

Personnel and Adults with T2DM

Demographic Characteristics of Health Care Personnel

Demographic characteristics of health care personnel are presented in Table 4-8. There were 30 nurses comprising diabetic educator nurses (n=4) and nurses from medical and surgical wards (n=26). There were 16 doctors comprising family physicians (n=6), an endocrinologist (n=1), a general surgeon (n=1), a visiting physician (n=1), registrars (n=5) and senior registrars (n=2). Most health care personnel were female and more than half were in the age 30-39 year old age group. The majority of them belonged to the Sinhalese ethnic group and the Buddhist religion. More than half of the nurses (76.7%) and doctors (68.8%) had 1-10 years of

experience for caring for adults with T2DM. However, one important finding was although the majority of the nurses had many years of experience for caring for adults with T2DM, only four (13.3%) had special training in diabetic care, while majority of the doctors (87.5%) had special training in diabetic care.

Table 4-8
Demographic Characteristics of Health Care Personnel

Demographic characteristics	Number (%)	
	Doctors (n=16)	Nurses (n=30)
Gender		
Female	9(56.3)	27(90.0%)
Male	7(43.7)	3(10%)
Age (years)		
20-29		7(23.3%)
30-39	7(43.7)	16(53.3%)
40-49	5(31.3)	6(20.0%)
≥ 50	4(25.0)	1(3.3%)
Ethnicity		
Sinhala	15(93.8)	30(100%)
Tamil	1(6.2)	
Religious practice		
Buddhist	12(75.0)	30(100%)
Hindu	1(6.2)	
Catholic	3(18.8)	
Experience with care for type 2 diabetics (years)		
1-10	11(68.8)	23(76.7%)
11-20	1(6.3)	6(20.0%)
21-30	3(18.7)	1(3.3%)
>31	1(6.2)	
With Special training for diabetes care		
Yes	14(87.5)	4(13.3%)
No	2(12.5)	26(86.7%)

Demographic Characteristics of Adults with T2DM Who Participated in In-Depth Interviews

Demographic characteristics of adults with T2DM are presented in Table 4-9. There were 17 adults with T2DM including those who had controlled glycemic levels (n=7) and uncontrolled glycemic levels (n=10). Their ages ranged from 32-77 years of age with the mean of 50.0 (SD =11.8). Two third of participants were female (70.6%) and all were married. Most were Sinhala (94.1%) and Buddhist (94.1%). More than half (58.8%) were educated above grade 10 and had incomes over 21,000 rupees (70.6%). A high proportion of participants (70.6%) used insulin to control glycemic level.

Table 4-9

Demographic Characteristics of Adults with T2DM Who Participated In In-Depth Interviews (n=17)

Demographic characteristics	Number (%)
Gender	
Female	12(70.6%)
Male	5(29.4%)
Age (years)	
30-39	3(17.6%)
40-49	5(29.4%)
≥ 50	9(52.9%)
Range =32 -77	
\bar{X} (SD) = 50.0 (11.8)	
Ethnicity	
Sinhala	16(94.1 %)
Muslim	1(5.9%)
Religious practice	
Buddhist	16(94.1%)
Islam	1(5.9%)
Educational status	
≤ grade 10	7(41.2%)
> grade 10	10(58.8%)
Income (Sri Lankan rupees)	
5000 -10,000	1(5.9%)
11,000- 20,000	4(23.5%)
>20,000	12(70.65%)
Duration of diagnosed with T2DM (years)	
1-5	7(41.2%)
6-10	3(17.6%)
>10	7(41.2%)
Fasting blood sugar levels (mg/dl)	
<126	7(41.2%)
>126	10(58.8%)
Range = 105.0 – 296.0	
\bar{X} (SD) = 164.4 (59.2)	
Used medication type	
Oral hypoglycemic agents only	5(29.4%)
Insulin	12(70.6%)

Qualitative findings are presented here as three themes: barriers to control glycemic levels; reasons for adequate glycemic control; and suggestions to improve glycemic control. Relevant categories and subcategories are also presented in Table 4-10.

Table 4-10

Themes Arising from Interviews with Health Care Personnel and Adults with T2DM

Barriers to glycemic control	
As perceived by health care personnel	As perceived by adults with T2DM
Insufficient knowledge about the illness	Insufficient of knowledge about the illness
Nature of the illness	Nature of the illness
Blood sugar control and consequences	Blood sugar control and consequences
Low socioeconomic status	Low socioeconomic status
Inadequate income	Inadequate income
Low health literacy	
Lack of family support	Lack of family support
Lack of family caregiver	Poor support for having separate meal
	Poor support for follow up
Poor compliance to health advice	Poor compliance to health advice
Denial in accepting the disease	Fear about diabetic medicine
Fear about diabetic medicine	Having a busy life
Lack of motivation	Lack of motivation
Having a busy life	Having other diseases
Having stress	
Insufficient diabetes care	
Lack of staff	
Unavailability of medicine	
Lack of relevant investigations	
Lack of facilities	

Table 4-10 (continued)

Reasons for adequate glycemic control	
Understand about the illness Knowledge about the diet control Taking medicine regularly Doing follow up	Understand about the illness Knowledge about diet control Taking medicine regularly Doing follow up
Sufficient family support	Sufficient family support
Adequate income and education Sufficient living status Adequate educational status	Adequate income and education Sufficient living status
Motivation to control Commitment to follow health advice Perceived risk Avoid by blaming	Motivation to control Commitment to follow health advice Positive thinking Perceived risk
Suggestions to improve glycemic control	
Improving knowledge about diabetes Using appropriate teaching strategies Educating family members Raising awareness about patient responsibility	Adhering to health advice Do diet control Do exercise Take medicine regularly Follow clinics regularly
Enhancing motivation to diabetes control Providing better diabetes care Improve facilities Increase number of trained health care personnel Improve doctor-patient relationship	

Barriers to Control Glycemic Levels

There were a number of barriers to control glycemic levels as perceived by health care personnel and adults with T2DM such as insufficient knowledge about the illness, low socioeconomic status, lack of family support and poor compliance to health advice. Furthermore, health care personnel perceived that insufficient diabetes

care was another barrier to provide diabetic care for adults with T2DM. Each of these categories are discussed as below:

Insufficient knowledge about the illness. Many health care personnel indicated that adults with T2DM have insufficient knowledge about illness, such as the nature of the illness, blood sugar control, the consequences of not engaging in diet control, and regular exercise. Most commonly, the link between these behaviors and glycemic levels were highlighted.

With regard to the nature of the illness, most of adults with T2DM did not know it is a progressive metabolic disease which cannot be cured and needs a lifetime of blood glucose control. Especially, the severity of the level of blood glucose does not have the impact on patients' well-being and it was most commonly highlighted. Some of them expressed their ideas as follows:

Most of the patients know that they have diabetes but not the gravity of the disease. Most of the people know when their blood sugar is high that it is diabetes. They don't know that diabetes is a metabolic disease which affects all organs in the body that knowledge is not there. Some people think if they don't have symptoms their diabetes is cured. (Doctor)

Most of them don't have good glycemic control, because the severity of the glycemic control has no impact on the patient's wellbeing. Patients feel well and they think they are ok but if you check their blood sugar it is high so when they have a problem only then they start to check it. (Doctor)

When we ask why didn't you take your drugs as recommended? They said Miss, last time my blood sugar became normal, so I stopped taking medicine. I thought my diabetes got cured. (Nurse)

Patients have poor compliance to medicine, because they don't feel any symptoms with high sugars levels so they don't take medicine as recommended. (Nurse)

Interestingly, some adults with T2DM and uncontrolled glyceic levels mentioned that did not take their medicine because they felt normal;

I stopped taking sugar tablets because I do not feel anything different. I feel good and I can work, I thought it is cured. (Adult with uncontrolled glyceic level)

I didn't take my drugs for many days because I think if my body feels well there is no need to take them, but sometimes I feel faintish like there is not enough energy in my body. (Adult with uncontrolled glyceic level)

Furthermore, in terms of blood glucose control and consequences, health care personnel perceived that most adults with T2DM did not know how to control their blood glucose levels and overcome the consequences; especially effects of the high and low blood glucose levels:

Our diabetic patients don't know much about the disease. They don't know how to control it, why they have to control blood sugar levels and what they have to do to control their blood sugar level, what are the complications of uncontrolled blood sugar levels. (Doctor)

We have lot of recurrent admissions of diabetic patients. The reason is our diabetic patients don't know how to do diet control and why they have to do it, exercise and the need for regular clinic follow up. (Nurse)

In contrast, though health care personnel perceived that adults with T2DM lacked of knowledge about the illness, most with both controlled and uncontrolled glycemic levels were aware that that diabetes is a disease about the sugar level in their body which needs to be controlled, otherwise they get complications. Some of them explained it as follows:

I know this disease is not good for our body. We have to control our sugar level well if not we will get heart attack, cut our legs, I know this disease, it affects all parts in our body. (Adult with controlled glycemic level)

I know diabetes is a serious disease, sometimes can get heart attack, cut legs, we learn these from the clinic. If we can control our sugar level is good for our life. (Adult with uncontrolled glycemic level)

In addition, some health care personnel mentioned that patients' had insufficient knowledge about how blood glucose control can be achieved by diet control, specifically portion size, meal planning, regular meal times and regular cardio exercise. The lack of knowledge acts as a barrier to control glycemic levels. Some of them shared their ideas as follows:

We don't know what they do as diet control at their home setting. When we ask from them they said "Yes we are taking red rice for our meals, and don't put sugar into our tea don't eat sweets" like that. Actually it is not diet control. It should be the portion size, meal planning according to their body weight. (Doctor)

Once we tell our patients to walk or do some exercise they said that they do enough household work. No need to do additional exercise like that. (Nurse)

Our patients don't know what cardio exercises are, what aerobic exercises are. Patients think if they do lot of house work that is their exercise. (Doctor)

Congruent with these perceptions from health care personnel and previously mentioned quantitative data, most of the adults in this study mentioned about eating red rice, not taking white sugar with their tea as their diet control. Most of adults perceived that as they have enough work to do, so there was no need to do exercise additionally, for example:

After having this diabetes, I stopped adding sugar into my tea. I eat red rice for three meals, earlier I used to eat white rice but the nurse told me to eat red rice and I changed it but still my sugar is high. (Adult with uncontrolled glyceimic level)

I have enough work to do every day, I go to work and when I come back home I have lot of things to do. That is enough as my exercise, no need to walk additionally. (Adult with controlled glyceimic level)

Low socioeconomic status. A number of health care personnel and some of the adults with T2DM with uncontrolled glyceimic levels mentioned that low socioeconomic status acted as a barrier to adequate glyceimic control. The most commonly mentioned barrier was inadequate income to buy medicine and recommended food, and come to clinic for follow up regularly. Some of them expressed their ideas as follows:

A lot of our patients have financial problems also. It affects their blood sugar control. If they don't have money they don't buy medicine or they don't come to the hospital. (Nurse)

Lots of patients say that they cannot buy insulin because it is expensive sometime it is not available at the hospital for 3-5 months so patients have to buy it from the outside. One bottle is around 1500 rupees and they don't buy it. (Doctor)

Insulin is very expensive, I have an insulin pen but need to load it 5 times per month, it is expensive, needles and syringes also have to buy it. These need lot of money, my husband earns in my family but it is not enough for our living and to buy insulin every month (Adult with uncontrolled glycemic level)

Nowadays quality vegetables are expensive, fruits are also highly priced, and rarely can we buy them. (Adult with uncontrolled glycemic level)

These days vegetables are expensive so it may be difficult for patients to buy them (Nurse)

In addition to that health care personnel noticed that patients' educational level was also important to understand health advice and practice the recommended behavior, for example:

Most of our patients are not rich, most of them are not much educated, sometimes they cannot understand what we are telling them, so most of them don't know about diabetes, its complications, how to control it, why they need to control and so on, that is the major problem we have. (Nurse)

Our patients are on the average educational level so we can educate them on the simpler way but some of them might not take the disease seriously depending on their educational level as well. Convincing our patients to control diabetes is also a little bit difficult and may be due to their educational level it also is a reason to have poor control. (Doctor)

A Knowledge regarding the illness and patient' educational level to understand our advice and the illness is also important to control glyceimic levels. (Doctor)

Lack of family support. Besides these barriers health care personnel noted that without having a family care giver, it is rather difficult to control glyceimic levels. Support from a family care giver was needed to administer insulin injections and to attend follow up visits to diabetic clinics. As most of the adults with T2DM are middle aged, they have poor vision due to the illness or their age. Once these patients need insulin injections, they need somebody inject it for them. Therefore, health care personnel ask a family member to come to the hospital to teach the method to administer insulin injections, but rarely family members come to learn it. Some of them shared their ideas as follows:

These patients don't have family support. Some of these patients that needed insulin are old. They have poor vision or retinopathy, so they cannot draw and inject the insulin by themselves, so we have to ask somebody to come to teach it, but family members don't come. (Nurse)

When we ask a family member to come to teach how to give the insulin injection nobody comes, so sometime we convert insulin to oral and discharge, and then the patient doesn't get enough control for his diabetes. (Doctor)

Additionally health care personnel mentioned that adults with T2DM do not come for the follow up due to lack of family support, such as children do not know that their parents have diabetes. Patients are old and they cannot come to the follow up alone. Family support is highly needed when having a diabetic wound. Some of them expressed their ideas as follows:

Sometimes children do not know that their mother has diabetes. She needs to go to clinic, needs to take medicine like that. Once their mother gets sick or until the wound get maggots they do not know it. Once their mother is very sick and needs to be admitted only then they know it. (Nurse)

When we discharge a diabetic patient with a wound we ask them to come to the ward every other day for wound dressing. They come only one or two times ... so daughter or son or wife or somebody should help the patient to come to the hospital... patient cannot come alone because of the wound in their leg... walking or getting to a bus, getting down from the bus are not easy to do by themselves. (Nurse)

On the other hand adults with T2DM perceived that they cannot adhere to the prescribed diet due to lack of support from their family to prepare a separate meal. This was mainly observed among female patients with T2DM. They need to prepare the meal according to their family preferences and not only for themselves. Also, preparing a separate diabetic meal was not practical for the patients, some participants expressed:

I have three daughters and I have to cook for them. I have to cook what my family likes to eat. I cannot cook separate meal for myself, so I eat whatever I prepare for my family, so I cannot strictly control my diet. (Adult with uncontrolled glycemic level)

Actually it is very difficult to control the diet. I have to cook for my family, and my children do not like to eat red rice, they like to eat white rice, dhal, potato, but it is not good for my illness, but I cannot cook separate meal for me and another one for them. So I eat what we all eat as a family. (Adult with uncontrolled glycemic level)

With regard to clinic follow up some participants stated that it is difficult to go to hospital every month because they have to go there two times each months, need to go there very early to get a number, have to wait for a long time at the clinic and at the pharmacy and they cannot do it all by themselves. Some of them did not get enough family support to go for wounds dressings and their wound got worse, for example:

You know I have to go to the clinic every month, I have to go there very early in the morning. Before I go to the clinic I need to get sugar report for this also I have to go there very early. They give only 30 numbers per day to check blood. Then two times per month I have to go there, one time to give blood to check and then to the clinic. It is very difficult, I have to go there alone. My children go to work and cannot come with me. I cannot stand a long time at the pharmacy queue... so I show my clinic book to the pharmacy and buy medicine from there. (Adult with uncontrolled glycemic level)

When I went home from the hospital last time, the nurse told me to come to the hospital to care to the wound in my leg. At first my son came with me. He also cannot come every day he has to go to work... My wound got bad, I was admitted to the ward again. (Adult with recurrent amputation within three months)

Poor compliance to health advice. According to health care personnel, poor compliance to health advice due to denial to accept the disease, fear about medicine, having a busy life, lack of motivation, and having stress, are commonly highlighted.

In terms of denial to accept the disease, health care personnel encountered that most adults with T2DM do not like to accept the disease. They are in a dilemma

to accept or not and in turn influence their glycemic control. Further they mentioned that causes for this denial to accept the disease may be patients may think they cannot eat anything, having diabetes is like a social taboo, want to hide the disease from others, and may get medically condemned. Such as:

Actually most of them don't like to accept the disease. They take it as a social taboo, so once we tell them that you have diabetes they don't like to accept it. They are in a dilemma, they are really not accepting it, so that is the biggest problem. (Doctor)

Some patients don't like to accept as well as they want to hide that they have diabetes. Sometime they told us not to tell anybody that they have diabetes, may be due to the fact they cannot eat as they wish and they cannot live as a normal person. (Nurse)

One time our hospital minor staff was admitted to our ward and she told us please do not tell anybody that I have diabetes, because I may get medically condemned and lose my job. (Nurse)

Regarding fear of diabetes medicine, a number of health care personnel mentioned most of adults with T2DM are afraid to take diabetes medicine due to many reasons, such as having experience of side effects, like diabetes drugs make a bad taste in their mouth, get hypo or hyperglycemia and some of them do not like to get insulin due to needle phobia. Some of their ideas as follow:

Poor compliance to medicine is common among our diabetic patients. The problem with these people is they don't take the drugs properly. They take their drugs from our pharmacy but when they go home they do not take it as we advise them, because they said that after taking metformin they feel a bad taste in their mouth, no desire to eat like that. (Nurse)

If they get hypoglycemia, they feel faintish and get afraid what is going on his/her body like that and then what they do is they try to reduce the drug dosage, or stop taking it. Many patients don't get proper dosage regularly. (Doctor)

Lots of patients say that they don't like to get insulin and insulin is also expensive. Also they have needle phobia too and it is painful, so they don't like to get it and when we order insulin they said "doctor please give oral drugs I don't like to take insulin". It is difficult so what we can do we give the maximum dosage of oral drugs only to them but they cannot have good glycemic control and the prevalence of complications also high. (Doctor)

Interestingly, some of the adults with T2DM also stated that they have fear about diabetes medicine and hence they do not take it as prescribed. Further the majority did not like to get insulin because they did not like the needles and its pain, for example:

This diabetes disturbs my day-to-day life a lot. When I take metformin in the morning I feel faintish, lazy I cannot work. If I get faintish in a bus or on the road what will happen to me? I am afraid, so sometimes I don't take it as they told me. (Adult with uncontrolled glycemic level)

I was afraid when the doctor told me that he will give me insulin but I said no, the injection is painful, I cannot do it. (Adult with uncontrolled glycemic level)

As perceived by health care personnel, another reason to get fear about diabetes medicine is that patients believed that diabetic medicine is harmful to their body organs. Therefore, they tend to stop or reduce their drug dosage by themselves. For example:

Many diabetes patients think taking metformin for long time is harmful for their kidneys and they stop taking it. (Nurse)

The majority of noncompliant patients believe these diabetes drugs can harm especially their kidneys. Drugs can be toxic to kidney, they believe like that, so they stop taking drugs” (Doctor)

Similarly, some adults with T2DM also stated that they are afraid to take diabetes medicine for long time, because they have heard that this medicine is harmful to their kidneys. Some of them expressed their ideas as follows:

I heard that taking metformin is not good for kidney and later kidney will be destroyed. The doctor told me to take metformin three times for a day but I don't take the middle one, I think taking this much of metformin will harm my kidneys. (Adult with uncontrolled glycemic level)

Moreover, several health care personnel suggested that diabetes health education is ineffective if the patient does not have a motivation to follow them. Some of them expressed their experience as follows:

Even we educate them, they don't want to follow our advice. Patients' motivation is very poor to control their blood sugar level and they don't like to change their lifestyle. Even if we educate them they don't like to change. (Nurse)

We tell them, educate them every time when patients come to clinic but some of them are not motivated to do so. (Doctor)

However, though health care personnel perceived that adults with T2DM have poor motivation to follow their advice, these adults were having some other

difficulties to adhere to advice such as difficulty to change their food habits and having other diseases. Some of their ideas as follow:

I usually eat rice more than one cup, it is difficult to eat one cup of rice I feel hungry. They advise us to eat less rice, more vegetables, eat more green leaves but you know it is very difficult to eat one cup of rice. I tried it but I feel very hungry. (Adult with uncontrolled glycemic level)

I have to do exercise but I don't do it, because I have heart problem, so I cannot do it. (Adult with controlled glycemic level)

I don't do exercise like walking because I have pain in my both legs. In the past I went to walk but when I come back I have to sit for long time. (Adult with uncontrolled glycemic level)

With regard to having a busy life, the aforementioned quantitative data also stated that more than half of the adults with T2DM did not practice exercise regularly and one third of them were unable to do diet control due to their busy life. Likewise, several health care personnel emphasized that due to busy life adults were unable to adhere to diet control or exercise behavior. Lack of time is the most commonly mentioned barrier which may lead to giving less priority in this context. Some of them expressed their ideas as follows:

Most of our diabetic patients are middle aged and are working people. They have very busy lives, so they don't have enough time to do diet control, and exercise. They just eat maybe snacks or easy food and go to work, so they don't give priority to their diabetes control. (Nurse)

They don't take it as priority, mostly patient have lot of house work, office work so they don't give priority to their diabetes. (Doctor)

Most patients are doing some sort of work, they are working people, so to devote some time for exercise is not possible for them. We give many responsibilities to them, so they don't do all so we often failed. Patients forget it with their other work. (Doctor)

Furthermore, findings from quantitative data revealed that one third of adults with T2DM do take medicine as recommended. These findings were congruent with the perception of many adults with T2DM with uncontrolled glycaemic levels because they mentioned that due to their busy life, it is difficult to follow recommended medical advice. Some of them shared their ideas as follows:

I take insulin two times per day. Some time I cannot take at proper time. I do all of my housework, even I don't go to a job I have many thing to do at my home. Sometime I don't have time for this diet control, taking medicine on time. (Adult with uncontrolled glycaemic level)

I don't do diet control it is difficult to do with my job. I know that I have to do it but difficult to eat like that. Nurse told me to do exercise but I can't do it with my job, I wake up early morning to go to job and I go home very late so I don't have time to do exercise. (Adult with uncontrolled glycaemic level)

I don't have time to do exercise, when I go home I have to cook and help for my children to do their homework and then I have to clean the kitchen. Again I have to wake up at 4 on weekends, I clean my home. My children cannot help me. They have to do their education work. I have to do all the things at home, so I don't have time to do exercise. (Adult with controlled glycaemic level)

In addition to this some health care personnel reported that patients with uncontrolled glycaemic levels have many kinds of stress, like job stress, family problems, and income matters in their daily life. Likewise adults with uncontrolled

glycemic levels also reported that that they have high job stress which distracts them from following recommended behavior, for example:

Our country people have to struggle for their living, for diabetic patients also same. They have lot of stress due to their job, children, family matters so they don't do diet control or any other things as we tell them, so it may affect their sugar control. (Nurse)

Our patients have lot of stress for living, working. This also affects their sugar control. They eat whatever they can afford and have no time think about their diabetes. (Doctor)

I know this is a dangerous disease because we don't control our mouth, but it is difficult to say like it happened because of sugar intake, because I take my insulin well and do diet control also, but my sugar level is still high. So I think it is something with my job stress. When I don't have much work my sugar level go to 120, 110. (Adult with uncontrolled glycemic levels)

I think my main problem is I have lot of job stress. It is the reason for this much of high blood sugar levels. I try to control it but it is very difficult. My job is very stressful. (Adult with uncontrolled glycemic levels)

Insufficient diabetes care. Besides aforementioned barriers health care personnel also stated that a number of barriers to provide effective diabetes care were a lack of staff, unavailability of medicine, lack of relevant investigations and lack of facilities. The most commonly mentioned barrier was due to lack of staff, so they were unable to provide proper health education. For example:

A lot of patients in our wards, not only diabetes patients, so sometimes we cannot pay enough attention to these diabetes patients due to shortage of

nurses. So we cannot give proper health education for each and every DM patient. (Nurse)

It is very difficult to give health education to everybody in the clinic. We give very minimum health education. In the clinic there are about 400 patients per day so doctors don't have time even to talk with the patients. The number of patients in the clinic is very high, we are tightly packed. (Doctor)

All these happened due to a lot of patients. You can see the number of patients who come to the clinic is increasing every month. Most of the things cannot be given to the patients because the number of patients are so high. (Doctor)

Importantly, health care personnel indicated that the availability of a limited number of specialized health professionals like diabetes educator nurses, dietitians, and community nurses are barriers to provide effective care for adults with T2DM.

In this hospital we have four diabetic educator nurses and two of them work in the clinic and others have to go to all wards. We have lot of diabetic patients but not enough diabetic educator nurses. (Nurse)

This hospital has only one dietitian and lot of diabetic patients. We cannot get dietitian advice to these diabetic patients. We don't have enough trained people to educate them. A lot of patients come to our clinic but few doctors. We have only three nurses it is not enough. (Doctor)

Nurses don't know what will happen to patients when they go home. No health care personnel to look after them in the community. There are no community nurses or other health care personnel to care for them when they are at home. (Nurse)

Many patients don't have better control because their insulin injection technique is wrong even though we teach them many times. If we have a public health nurse she can support them. (Nurse)

Not surprisingly, according to the demographic data from nurses who participated in focus group discussions, the majority of them (87.3%) did not have specialized training for diabetes care. Thus lack of updated knowledge about diabetes was mentioned as a barrier to provide care by most nurses in this study.

More nurses have general knowledge on diabetes from their basic nursing training, very few chances to get special training. So we need more training about updated knowledge in diabetes care. (Nurse)

Furthermore, health care personnel mentioned that unavailability of diabetic medicine and lack of relevant investigations were barriers to providing diabetes care for adults with T2DM:

Some investigations like HbA1c, urine micro albumin are not available in the hospital and sometimes drugs are not available in the hospital. These things have an impact on glycemic control. (Doctor)

We don't know what our patients' actual glycemic control is, because we don't have the facility to do HbA1c in the government setting. It is very expensive to get done in an outside laboratory. Our patients cannot afford it. (Doctor)

Additionally, many health care personnel stated that a lack of facilities such as long queues at the clinic, absence of diabetes centers in the community, other hospitals not having relevant medicine, and no proper referral system are barriers to providing effective diabetes care. For example:

Most of our patients don't like to come to the diabetes clinic, because it takes lots of time. There is a long queue in the pharmacy, so they show their

prescription to the pharmacy and continue the drugs, without screening for FBS. (Nurse)

Sometimes we refer our patients to a nearby hospital but they don't like to go there because most of the time diabetes medicine is not available in those rural hospitals. (Doctor)

Some patients don't come to clinics regularly because the hospital is too far from their home, and also there are no diabetic centers in the community to get treatment. (Nurse)

The specialists are burdened with minor cases. They don't have time to deal with serious cases like diabetes, and in here there is no referral system. (Doctor)

Reasons to Adequate Glycemic Control

There were several reasons to control glycemic levels such as understanding about the illness, sufficient family support, adequate income and education, and motivation to control. Each of these categories are discussed as follows:

Understanding about the illness. Health care personnel indicated that understanding the illness, its progression and how to control it among adults with T2DM facilitates compliance to health advice and leads to having adequate glycemic control, for example:

These people who are having good control, they know about their illness that they have to take medicine regularly, and complications of diabetes as well so they take their medicine properly, follow dietary advice correctly. These people are very few. (Doctor)

There are some patients, sometimes they know about diabetes better than us. They read books, newspapers and know more about diabetes and its control. They do diet control, exercise and take medicine regularly. Their blood sugar control is also good. (Nurse)

Interestingly, some adults with T2DM who understood the illness and its control had better glycemic control and do diet control, and took their medicine properly. Some of them expressed their experience as follow:

I know diabetes is a bad disease; we have to take drugs for long time. If we didn't control our sugar levels we can get damage to our eyes, kidney, we can get heart attack. I know this disease cannot be cure. We have to control. I know I have to control it and I can live without problem, so I do as they told me. (Adult with controlled glycemic level)

My parents have diabetes so I also got it. I know it is a disease we cannot cure but we can control it. I take my insulin on time. I eat a less amount of rice and more vegetables, try to go to clinic every month. If I control sugar like this I may not get problem. (Adult with controlled glycemic level)

Sufficient family support. As mentioned earlier adequate family support is a paramount reason to have better blood sugar control among adults with T2DM. Many health care personnel noted that patients with controlled glycemic levels have sufficient family support to have the prescribed diet and come to the follow up clinics. These family members promoted their behavior. Some of their ideas are as follow:

Some diabetic patients have good control because they have very supportive family members. Some of them said like "Miss, my wife is very concerned about my diet in our family. They don't bring sugary things to our home. My

son gave me a glucometer and helps me to check my blood sugar level like that". (Nurse)

Some children are very concerned on their mother's clinic date. They take the mother to the clinic, wait with the mother, and sometimes ask us what are the good food for their mother, when is the next clinic date, like that. (Nurse)

If family members can provide guidance on proper food, proper timing of drugs, compliance is very good. We have come across many patients with that family support. (Doctor)

Likewise, adults in this study emphasized that they have support from their family members to do diet control and take their medicine regularly, for example:

My husband helps me a lot. He buys good vegetables and fruits for diabetes and also he reminds me to take my insulin. Sometimes my children also remind me to take my drugs. My family supports me a lot (Adult with controlled glycemic level)

My husband is concerned with my disease more than me. He reminds me to take my insulin, you know, sometimes I forget to take it. He reminds me. If I eat a piece of cake he said it is not good for diabetes. Sometimes my daughter also blames me when I put sugar into my tea. You see they are concerned a lot about me. (Adult with controlled glycemic level)

Adequate income and education. Health care personnel in this study perceived that adults who are being educated and having sufficient living status can control glycemic levels.

Blood sugar controlled patients are the more educated people. They read more about diabetes and they know sometimes better than us. They have good understanding about their disease and can control well. Their living standards

are good. They are not in low income group. They don't have problems with money. In general people who have good blood sugar control relatively have better economic status. (Doctor)

Blood sugar controlled patients are much more educated and they have good living conditions. Some of them read books, newspapers ask us to get to know more about diabetes and its control. They are educated so they can understand what we are telling them. (Nurse)

Likewise, some adults with T2DM also mentioned that they read newspapers, books and watch health programs to learn more about diabetes. Some of them said they do not have financial problems to buy food or medicine:

We have enough money for food and our living status. Me and my wife both have pension and our children also help us. Sometimes I buy my medicine from outside and I do blood tests from "Asiri" (expensive private place for investigations). (Adult with controlled glycemc level)

When I have time I search Google for diabetes. There is a lot of new information about diabetes. I read newspapers and watch TV programs on health matters. (Adult with controlled glycemc level)

Motivation to control. As health care personnel perceived, adults with T2DM have adequate glycemc control due to their motivation to control. This motivation includes commitment to follow health advice, perceived risk, and avoidance of blame.

With regard to commitment to follow health advice, many health care personnel encountered commitment to do exercise, control diet, attend clinic for

follow up among adults with T2DM who have adequate glycemic control, for example:

There are some DM patients doing exercise. They also have good diet control and are very motivated to control their blood sugar but these are very few numbers. These DM patients are educated and have better knowledge about diabetes and its control. (Nurse)

These controlled patients are very motivated to control their blood sugar level. Sometimes they call me and ask to know about some food. They follow our advice very well. (Nurse)

These blood sugar controlled patients are motivated to control their blood sugar level. They strictly follow our advice. They think about their disease with whatever duties they have. They come here and check their blood glucose level monthly, do follow up regularly. (Doctor)

Likewise, some adults with glycemic control mentioned about their commitment to change their food habits:

I try to control my rice amount first, so I eat some fruit and then eat lunch, and then I can reduce the rice amount. I eat rice and curries for my breakfast and lunch but I eat light thing for my dinner. (Adult with controlled glycemic level)

I take metformin regularly I go to clinic regularly. If I want to eat a piece of cake I eat, but that day I take less rice. I eat lot of vegetables; in my family we eat vegetables well enough. Usually we eat rice and curry for three meals but I eat less rice amount. (Adult with controlled glycemic level)

In addition, many adults with controlled blood sugar level emphasized that they think about diabetes in a positive way. Perhaps this positive thinking leads them to control their glycemc levels, as described:

I don't worry about me having this disease. I know this is not like a cancer. If I control my sugar I can live longer, so I don't worry and take this as a serious thing. I think if I control it I will not get problems, so I start not to worry and do what they told me to do to control my sugar.

I know diabetes is a bad disease; we have to take drugs for long time. If we didn't control our sugar levels we can damage our eyes, kidney, we can get heart attack. I know this disease cannot be cured. We have to control. First I cried a lot why I get this disease, but later I make up my mind, now I know I have to control it and I can live without problem, so I do it.

I don't take it as a serious thing if I control it I may not get problem I don't think I am a patient like that.

However, some nurses perceived that some patients, especially females have motivation to control their glycemc levels because they love their family or their children and think their children will get diabetes. They are afraid of this, afraid to die due to diabetes, then nobody will take care of their children. Some of them shared their ideas as follow:

Some diabetic patients are very concerned and try to have a proper diet for the family, because they are very afraid about their children will get diabetes like them. They don't like to see that their children get affected with diabetes, so they take a proper diet as a family.

They control their blood sugar because they are afraid to die or have other kinds of diabetes complications because they think about their children if they

die or are disabled who will take care of their children like that? They ask lot of questions from us on how to control their blood sugar. I think they do like this because they love their children so much

Likewise, some adults with T2DM mentioned about this:

I want to control my sugar levels more, if something happened to me nobody will look after my family. (Adult with uncontrolled glycemc level)

I want to control my sugar because if I die or get hospitalized there is nobody to look after my children. I want to be in good health until my children get a good life in future. (Adult with controlled glycemc level)

Health care personnel mentioned that some patients were motivated to control glycemc levels after their perceived risk or having observed a relative getting complications from diabetes.

Until they feel well they don't think about medicine. Once they get a complication then they decide now is the time to go to see a doctor or take the medicine again. (Doctor)

Some patients get concerned after they get amputation or other kinds of complications. After that they are in very good in control, but sometimes it is too late. (Nurse)

Now I have lost two fingers, this is my carelessness. I want to control my blood sugar levels. (Adult with uncontrolled glycemc levels)

I saw how my mother suffered. She did not take drugs properly. She ate what she wanted and finally she got amputation and died because of diabetes. I do not want to be like that, I want to control blood sugar. (Adult with uncontrolled glycemc levels)

Additionally, nurses were aware that some patients try to control their blood sugar level to avoid getting blame from doctors or nurses, for example:

When they have to come to the clinic they have to check FBS and PPBS, so before checking this FBS they purposely do good diet control for a couple of days or eat more karawilla (Bitter guard/bitter melon) for few days or whatever they can do to reduce their blood sugar level and do the FBS and come to the clinic with good control. They do like this because if they come here with high blood sugar levels the doctor will scold them so they want to avoid that. (Nurse)

When their clinic date is coming they do diet control well take medicine regularly and some patients drink karavila (Bitter guard) juice, eat thebu (herbs) every day and try to reduce their blood sugar or some time they keep on fasting more than 10 hours to get good blood sugar report, and they come to see the doctor and get medicine. They cheat like this to avoid blame from doctors or nurses. (Nurse)

Suggestions to Improve Glycemic Control

Health care personnel proposed some suggestions to improve glycemic control among adults with T2DM, such as improving knowledge about diabetes and its control, complications, among type 2 diabetics and their family members, and providing better diabetes care for them.

Improving knowledge about diabetes. A number of them suggested that using appropriate teaching strategies such as mass media, small group discussion and individual health education will be useful. Moreover, as mentioned by the health care personnel, continuous education by repeating the advice and the importance of

patient-centered diabetes education, was suggested in improving their knowledge. Educating family members about diabetes was also further highlighted.

In terms of using appropriate teaching strategies a number of health care personnel suggested that including a number of photographs/videos of amputees, or blind patients as diabetes complications in mass media programs will make patients get frightened about the disease and enhance their motivation to control. Further, they mentioned that these media clips can be displayed in the clinic or at the outpatients departments. Some of them suggested doing small group discussion in the clinic area and then they can discuss their problems with each other. Another health care personnel stated that if possible to provide individual diabetes education. It is good to motivate and enhance their glycemic control:

We should have made people aware of it, facts like if your diabetes is not under control it may affect your eyes, feet, kidneys those things should be told to them by all means by electronic media, print media by using all these as much as possible. This is the only way that we can give the message to our people (Doctor)

If we can do small group discussions with diabetes patients, they can discuss their problems about diet control, medication taking, and exercise like that. Then we as health care personnel can get their ideas problems and provide solutions or at least give options to solve the problem. I think it is very useful to educate them. (Nurse)

Our patients think their diabetes can be controlled by doctors not by themselves. Patients do not think and also may do not know that control of diabetes or blood sugar is the main responsibility of the patient. This “self-management” concept is not in here, so we have to educate them on self-management. (Nurse)

If we can do individual teaching sessions on diabetes control I think it will be ideal to improve their knowledge and control but it is very difficult to do that here. A lot of patients are here every day. (Doctor)

General trend is in leaflets. There are lots of wordings. Patients might not go through them, have to change that approach, need some audiovisual things so they can preview the seriousness of the diseases at a glance, and need video messages as well. (Doctor)

Let them be educated that diabetes is increasing. People who are diabetics already should be given some sort of regular education not just giving a little leaflet about diabetes and control. For diabetics they must show the people who have got ulcers, people got kidney problems, and people got amputation, people got blind like that and then at least it is something which is frightening and strikes a bell in patient. (Doctor)

The majority of health care personnel in this study stressed that the importance of continuous motivation about diabetes control and the need to provide patient specific health advice rather than giving general health advice. This is because diabetes is a long-term disease which needs long-term adherence. Perhaps, this kind of patient-centered education, promotes long term adherence to the health advice.

Some of them expressed their ideas as follows:

We can educate patients properly, need some proper audio-visual aids that would be helpful because however much we tell them they will forget due to their other problems Patients will remember our advice today and up to may be one week and they will forget, so need to educate as well as continuous reminding is needed. (Doctor)

Most people will find it is difficult to adhere on a long-term basis. Anyone can adhere to that for short term basis. When they have to do it for life time, it is a

difficult thing. We have to accept that anyone would not like to take medicine for a lifelong time, it is difficult to do. Therefore we always have look into their daily life and try to adjust it as much as possible without interfering much with their daily routine work. (Doctor)

Diabetes is a chronic disease, therefore we have to give an approachable diet to patients, and these have to be understood properly. It should be portion sized, properly, so that they eat according to their body weight. If we give some sort of dietary advice patients' adherence to dietary advice will be good. We have to ask the patient what exercise he/she can do and we have to promote that exercise. So deciding the exercise type is mainly selected by the patients and we should promote that exercise in order to improve the compliance to exercise. (Doctor)

For diabetic patients we have to get their very exact social, family background, economic status and everything and analyze according to the patient and all diabetes educational advice should be patient friendly. Dietary advice should be according to the patient. (Doctor)

Additionally, to improve knowledge about the illness educating family members was also highlighted by a majority of the health care personnel. This is because once the family member knows about diabetes, a suitable diet, and the importance of taking medicine on time, they can support the person with diabetes in their family. Some of them expressed their ideas as follows:

Need to educate our diabetic patients' families about the disease, its complications, diet control, exercise, clinic follow up, then they can support the person. (Nurse)

Educate their family members on diabetes and how to give support is also really needed to improve glycemic control. Then they can give more support.
(Doctor)

Involving a family member for the care, then we can talk with them advise them about the gravity of the disease then we can enhance their relatives' compliance. (Nurse)

On the other hand, most adults with T2DM with controlled or uncontrolled blood sugar levels in this study perceived that the need to adhere to prescribed health advice to improve their glycemic control. Some of their suggestions are as follow:

I want to control my diet more if I can do some exercise that is also good.
(Adult with controlled glycemic level)

I think now onwards I have to go to a clinic regularly and take drugs properly.
(Adult with uncontrolled glycemic level)

I need to take my tablets as doctor told me otherwise I will get problem (Adult with uncontrolled glycemic level)

Provide better diabetes care. Besides these suggestions most health care personnel proposed improving facilities, increasing the number of trained health care personnel and good–doctor patient relationships to provide better diabetes care. With regard to improved facilities most stated that need for relevant medicines to be available, the availability of investigations, community diabetes centers, and referral systems to improve diabetes care:

Getting HbA1c into the ministry hospitals, getting micro albumin to the ministry hospitals, and the availability of quality medicine will have huge impact on the long term outcome of patients. (Doctor)

If there is a diabetic center at the field it is easy for them, community nurses can educate diabetic patients, and their family members more easily. (Nurse)

Need referral system, government should improve facilities in other kinds of hospitals, need to improve our primary health care facilities for DM patients. (Nurse)

In terms of increasing the number of trained health care personnel, most mentioned that more nurses trained in diabetes care were required:

We need more trained nurses in diabetes care. We have only two diabetes educator nurses in the clinic. Not enough for this many patients. (Doctor)

Nurses need more training to upgrade our knowledge in diabetes care. Most of us have our general training nursing not specialized training. (Nurse)

Doctors mentioned the importance of doctor-patient relationships in better diabetes care as follows:

Doctor-patient relationship matters on blood sugar control. Doctors need an organized clinic and mindset to teach and treat diabetic patients, and cannot blame the patients. Doctors have to be organized in their diabetes care and should maintain good-doctor patient relationships. (Doctor)

In summary, based on the above qualitative information, both health care personnel and adults perceived that doing diet control, regular exercise and taking medication properly for the long-term are challenging behaviors for adults with

T2DM. They broadly agreed in identifying barriers to effective glycemic control, such as insufficient knowledge about blood sugar control, low socioeconomic status, lack of family support and poor compliance to health advice. Some of these findings were congruent with the previously mentioned quantitative data in this study. Furthermore, there were many barriers encountered by health care personnel in terms of providing quality diabetes care: lack of staff, unavailability of relevant medicine and investigations, and lack of facilities.

In contrast, interestingly those who overcame the above mentioned barriers had reasons to have adequate control of glycemic levels as perceived by both groups of participants. These reasons were: understanding the diabetes and its control, adequate family support, better socioeconomic status, and motivation to control. Further the findings emphasized some suggestions such as improving knowledge about the disease among adults with T2DM and their family members. Improving effective diabetes care in order to enhance glycemic control among adults with T2DM is a special aspect that was identified.

Discussion

The discussion is presented in three subtopics such as glycemic control, factors affecting glycemic control and barriers to control glycemic levels among adults with T2DM.

Glycemic Control Among Adults with T2DM

The major findings of this study clearly indicated that over two thirds of the adults with T2DM (71.3%) had poor glycemic control. Furthermore, majority of them (85.2%) did not practice any kind of exercise, nearly one third of them (28.3%) did not do diet control, and 23.4% did not take medication regularly. In congruence with the study, findings from other investigations too reported poor glycemic control among adults with T2DM. In Jordan, of 917 adults with T2DM, 65.1% had poor glycemic control, 67.9% did not practice exercise and 81.7% did not follow the prescribed diabetic meal plan (Khattab et al., 2010). In Kuwait and Saudi Arabia 66.7% and 73% of the studied population had not achieved the target glycemic levels respectively, with suboptimal adherence to diet, exercise and medication-taking behavior (Akbar, 2001; Al-Sultan & Al-Zanki, 2005). In UK, Fox, Gerber, Bolinder, Chen, and Kumara (2006) stated that 69% of the studied sample had not achieved the target glycemic control due to the poor adherence to diet, exercise and medication behavior.

Factors affecting glyceimic control among adults with T2DM

This study also showed a significant association between age and glyceimic control ($p < .05$) among the study participants. This may be due to the fact that middle-aged people are mostly retired and they may have more time to practice the prescribed behaviors to achieve the set target glyceimic levels. In addition, some studies have reported a significant association between BMI (Khattab et al., 2010) and educational status (Ahmad, Khalid, Zani, Hussain, & Quek, 2011; Khattab et al., 2010; Xu, Pan, & Liu, 2010) with glyceimic control. This was not consistent with the findings of the present study. In the present study among participants the BMI was high in 69.6% of participants and the educational levels were high in almost all participants (72.8%) although the glyceimic control levels were poor. According to the diabetes-related scientific literature diet control along with taking prescribed medicine is essential to attain glyceimic control. The quantitative results of the present study revealed that there was a statistically significant difference between the medication taking behavior and glyceimic control ($p < .05$). This result was similar with a study conducted by Daly et al. (2009) where participants report highest performance with taking their medication and most of them had lower HbA1c levels. Further, in this study participants were less likely to adhere to exercise behavior but more likely to follow regular medication as prescribed. This may be due to the fact that it is easier for participants to follow medication regimens than doing exercise. This result was consistent with other studies (Daly et al., 2009; Khattab et al., 2010; Xu et al., 2010) where the majority of participants took the prescribed diabetes medication without exercise.

Furthermore, the qualitative information of the present study highlighted a number of reasons to have adequate glycemic control such as understanding the illness, sufficient family support, adequate income, higher level of education, and motivation to control. In terms of understanding the illness a quantitative study conducted by Ouyang (2007) among 185 Taiwanese adults with T2DM reported that only 22% of the subjects in their study were familiar with the concepts of diet control and its impact on their glycemic control behavior. In terms of family support: substantial research has documented that support from the family members positively influences diet control behavior among adults with T2DM (Albarran et al., 2006; Chlebowski et al., 2010; Wen et al., 2004).

Barriers to Glycemic Control Among Adults with T2DM

Qualitative findings from the present study revealed that lack of knowledge about the illness, low socioeconomic status, lack of family support and poor compliance to medical advice are barriers to glycemic control among adults with T2DM. Somewhat similar findings were reported from other studies as well. In terms of lack of knowledge about the illness, Jallinoja et al. (2007) highlighted that insufficient knowledge about the illness among diabetics is a key barrier to provide treatment as perceived by the health care personnel in their study. Moreover, Hurber, Hurber, and Shaha (2011) reported that patients' lack of understanding about the illness is a barrier to providing care as perceived by nurses. However, in contrast, Hu, Gruber, Liu, Zhao, and Garcia (2012) found that diabetes knowledge among 108 adults with T2DM was not related to their diabetes self-care behavior or glucose levels. However, a general stand point is the need to enhance knowledge about

diabetes and its control which is really essential to understand the course of the disease. In turn, improved knowledge promotes better glycemic control among adults with T2DM. This is further suggested by the health care personnel in this study.

Furthermore, two thirds of the participants (71.7%) practiced some dietary control in this study. Eating red rice/brown rice for the three main meals each day was the commonest dietary practice (53.0%), followed by eating two snacks per day (31.8%), and large portions of vegetables and fruits (15.2%). However, the glycemic control was inadequate among a high proportion of adults (69.7%) even though they practiced dietary control. The high proportion of participants with poor glycemic control is further substantiated with the qualitative information gained from both health care personnel and adults with T2DM in this study. In most instances the dietary advice they adhered to were the reduced intake of sugar or sweet tasting food (e.g. cake and other sweets), reduced consumption of sugar in a cup of tea or other beverages, and the use of red rice in the diet instead of bread white rice or white wheat flour products. They had no idea about the quantity of carbohydrate contained in food, the need to decide on the calorie intake depending on the body mass index and the activity level, the use of high fiber containing food, the need to time the oral hypoglycemic medicine with an appropriate volume of food. This indicates that most participants had insufficient knowledge about the illness, and the importance of diet control on a daily meal by meal basis. They specifically had no idea about what is diet control. They had the misconception that eating red/brown rice is the required form of diet control. The concepts of diet control such as portion size, meal planning, increased fiber intake, decrease in refined carbohydrate intake and a reduced intake of fat were not considered important by most T2DM patients. Another aspect of the

qualitative data was that most were not aware of the low cost high fiber content in vegetables and fruits. Readily available fruits and vegetables in the country promote better dietary control. In support of the perception of adults with T2DM in this study, regarding their diet control, Rais (2010) stated that many south Asian people with diabetes have many misconceptions. Some of these are that only table sugar and sweets will affect their blood sugar levels and so the patients with T2DM avoid them, whereas complex carbohydrates such as rice which do not taste sweet are not thought to cause a problem in the glycemic levels. In Taiwan, the study by Lai, Lew-Ting, and Chiet (2004) indicated that cutting sugary food was the diet control among adults with T2DM in their study. Therefore, the present study highlights the need to address these deficits in the dietary education program.

Low educational status may lead to low health literacy. Low health literacy may act as a barrier to understand and implement the given health advice. A number of studies have reported that high level of literacy is associated with better adherence to health advice which in turn helps to attain better control of diabetes (Cavanaugh et al., 2008; Rothman, Malone, Bryant, Dewalt, & Pigone 2002; Schillinger et al., 2002). The higher educational levels may facilitate adults with T2DM to learn and understand the nature of diabetes and take heed of the health advice.

Further, in terms of income, qualitative findings of the present study indicated that low income is a barrier to following dietary advice and taking the prescribed medication regimen. In Mexico, a study by Albarran et al. (2006) indicated that low income is a main barrier for adults with T2DM to buy medicine. A cross sectional study conducted by Daly et al. (2009) among 800 randomly selected

adults with T2DM, identified that cost is the most common barrier for diet control, followed by the next common barrier taking medication, regularly.

Regarding not doing diet control, the present study results revealed that one third of the participants (32.3%) had to eat what their family liked to eat. Hence, doing diet control is not an easy task as they lack family support. In both groups of study participants, the participants who achieved glycemic control as well as those who had not achieved glycemic control mentioned that having adequate family support promotes one to practice appropriate diet control. In congruence with these findings a qualitative study conducted by Carbone et al. (2007) among 37 adults with T2DM found that some participants cannot adhere to diet because of lack of family support. The importance of family support has been identified for exercise and medication taking behavior too. Wen et al. (2005) found the importance of family support in order to do exercise among adults with T2DM and reported that family support influences physical activities/exercise behaviors. As evident in this study some participants who had adequate glycemic control mentioned having adequate family support to take their medicine regularly. Chlebowy et al. (2010) study on facilities and barriers to self-management among T2DM provides a good example for family and peer support on medication adherence behaviors and exercise behaviors. A recent study conducted by Mayberry and Osborn in 2012, found that family members' non-supportive behaviors were associated with fewer adherences to medication regimen among their study participants. The same study concluded that when interventions are conducted they should inform family members about DM and enhance their motivation to facilitate medication adherence behaviors with family members with T2DM.

Moreover, in this study, one third of the participants did not take their medicine as recommended. The qualitative findings could be used to explain the reasons: perhaps these adults may have feared the misinformed side effects of the diabetes medication. Furthermore, they did not have the time to balance the medication intake time with meal times due to their busy life. Qualitative information from the current study also highlighted that many adults with T2DM were afraid to take their diabetic medications due to side effects of hypoglycemia. In line with the fear of diabetic medicine one study revealed that T2DM subjects were afraid to comply with continued medication due to the drugs being toxic to their kidneys (Lai et al., 2004). In another study, most participants feared the hypoglycemic effects of the medication (Shiu & Wong, 2002). A busy life style was identified as a barrier to regularly take the prescribed medication (Daly et al., 2009). Therefore, the present study highlights the need to improve knowledge about the medicines used to treat diabetes as well as motivate the adults with T2DM to adhere to prescribed medicine as informed in a diabetes education program for adults with T2DM.

The present study also revealed that health care personnel perceived a sense of denial amongst adults with T2DM to accept the disease, lack of motivation, lack of time due to having busy life, all acting as barriers to be compliant with health advice. These findings are supported by numerous previous studies conducted in many populations. As an example, a recent qualitative study conducted by Jones, Crabb, Turnbull, and Oxlad (2013) among health care professional and adults with T2DM in rural Australia found that denial to accept the illness, lack of time, lack of motivation, lack of knowledge and skills related to the illness all acted as barriers to diabetes self-management.

Sufficient diabetes related research has highlighted that a regular exercise regimen is an important behavior to control glycemic levels among adults with T2DM. In the present study the majority of the Sri Lankan participants (85.2%) did not practice any kind of exercise. Walking is the most common exercise among the subjects who did exercise and most perceived that doing a job or house work is enough as their exercise. Some of the identified barriers to regular exercise were lack of time to do exercise and having other disorders. A previous study also found that adults with T2DM considered doing physical work related to the occupation and home activities was adequate physical activity (Mier et al., 2007). A qualitative study conducted by Hasseler, Heide, and Indefrey (2011) found that having neuropathy, and cognitive impairment were barriers to regular physical activity. A systematic review conducted by Korkiakangas, Alahuhta, and Laitinen (2009) also associated the lack of time as a main barrier for an individual to engage in regular physical exercise.

Insufficient diabetes care too acts as a barrier to glycemic control. Most health care personnel in this study were overloaded with the massive number of patients attending the clinic. Hence health care personnel do not have the time or the facilities to provide individualized diabetic care. Patients with T2DM too perceived these as a barrier to receive individualized care. Similar findings were demonstrated in a study by Clark and Hampson (2003), where most health care professionals reported they do not have enough time and resources to treat and advise such patients effectively. Moreover, Hurber et al. (2011) highlighted the need to regularly train health care professionals to motivate the patients with T2DM to attain optimal glycemic control. In the present study, too, the need for regular intercommunication

amongst the health care providers was highlighted to promote better health care delivery.

In conclusion, in this study the proportion of adults with T2DM with poor glycemic control was high and there were several barriers encountered by these adults in order to control their glycemic levels. These findings are quite consistent with the reported studies from many other countries. An educational intervention that emphasizes the importance of proper diet control, advice on locally available food with low glycemic index, adoption of a regular exercise regimen, and adherence to the regular medications prescribed is essential. The educational intervention should be targeted to consider the patients' contexts to overcome the misconceptions and false fears of these patients. The study also sheds light on the poor resources available to diagnose and treat patients with T2DM in Sri Lanka. Low and inadequate staffing levels to cope with the large patient load seriously hampers efforts to provide appropriate individualized diet, exercise and behavioral advice. Furthermore, the findings from this phase shed light on the beliefs and practices related to Sri Lankan cultural contexts which may influence the glycemic control behaviors among adults with T2DM. What beliefs would have caused their diabetes? What practices do they do to control their disease? How do these beliefs and practices influence their life to live with diabetes? There are important questions that need to be answered to provide better care for adults with T2DM. Thus an ethnographic study is important, as a narrative of adults' lived experiences in their social context.