

Assessment of antidiabetic medication adherence and its effect on glycemic control in ambulatory patients with type 2 diabetes at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

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Abstract

Poor adherence to treatment of chronic diseases is a worldwide problem of striking magnitude. Adherence to long-term therapy for chronic illnesses in developed countries averages 50%. In developing countries, the rates are even lower given the paucity of health resources and inequities in access to health care. Poor adherence to recognized standards of diabetes care is the principal cause of development of complications of diabetes and their associated individual, societal and economic costs. Information on adherence to antidiabetic medications and glycemic control among Type 2 diabetes patients in Ethiopia is scanty. This study therefore sought to assess antidiabetic medication adherence and glycemic control among 322 ambulatory patients with Type 2 diabetes mellitus attending at the diabetic clinic of Tikur Anbessa Specialized Hospital (TASH). The study was a two phase, cross-sectional study conducted between 1 May-30 June 2014. Assessment of adherence was performed based on patients' response to the validated four-item Morisky instrument and the most recent fasting blood sugar level was used for glycemic control. Adherence rate to antidiabetic medications was found to be 66.8%. Younger age, increased number of prescribed medications and job type (being a farmer/daily laborer) were significantly associated with antidiabetic medication non-

adherence. Most of the patients missed their medications because of forgetfulness. On the other hand, only 12.7% of patients attained adequate glycemic control. Male sex, younger age, low educational status, regular alcohol intake, exercise and dietary non-adherence were observed to be significantly associated with poor glycemic control. Antidiabetic medication adherence appeared to be positively associated with glycemic control (COR= 1.23, 95% CI: 0.6-2.5). Taken together, the findings indicated that adherence to antidiabetic drugs was suboptimal and glycemic control was poor, which warrants the need for health care providers engaged in diabetic care to aggressively address the issue.

Key words: Antidiabetic Medications, Adherence, Type 2 Diabetes, Glycemic control, Fasting Blood Glucose

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List of Abbreviations

| | |
|------------|---|
| AOR..... | Adjusted Odds Ratio |
| CHS..... | College of Health Sciences |
| CI | Confidence Interval |
| CMAG..... | Case Management Adherence Guideline |
| COR..... | Crude Odds Ratio |
| CVD..... | Cardio-Vascular Disease |
| DM..... | Diabetes Mellitus |
| FBG..... | Fasting Blood Glucose |
| HbA1c..... | Glycosylated Hemoglobin |
| IDF..... | International Diabetes Federation |
| MAPS..... | Morisky Adherence Predictor Scale |
| SD..... | Standard Deviation |
| SMBG..... | Self Monitoring of Blood Glucose |
| SPSS..... | Statistical Package for Social Sciences |
| TASH..... | Tikur Anbessa Specialized Hospital |
| WHO..... | World Health Organization |

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1. INTRODUCTION

1.1. Background

Diabetes mellitus (DM) is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism, resulting from defects in insulin secretion, insulin action, or both (WHO, 1999). Complications of DM have become a major public health problem in all countries. It causes significant physical and psychological morbidity, disability and premature mortality among those affected patients and imposes a heavy financial burden on health services (EUDIP, 2002). Generally, 40% of patients with diabetes will develop microvascular or macrovascular complications in the course of their disease (MacKinnon *et al.*, 2008). The vast majority of cases of diabetes fall into two broad etiopathogenetic categories: type 1 and 2 diabetes (ADA, 2014; WHO, 1999).

Type 2 diabetes, which accounts for ~90–95% of those with diabetes, encompasses individuals who have insulin resistance and usually have relative (rather than absolute) insulin deficiency (ADA, 2014; WHO, 1999). It is an increasing worldwide public health issue and the number is increasing in every country with 80% of diabetic people living in low and middle income countries (IDF, 2013). The increase in incidence in developing countries follows the trend of urbanization and lifestyle changes, perhaps most importantly a "western-style" diet (Wild *et al.*, 2004).

According to the International Diabetes Federation (IDF), 382 million people were estimated to live with diabetes in 2013, out of which about 20 million were from Africa (IDF, 2013). The number is expected to rise to 41.4 million (109% increase) by 2035. Africa's most populous countries, including Ethiopia, have the highest numbers of people

with diabetes. Ethiopia, which is one of the developing nations, is at a risk of increased diabetes incidence. About 4.36% (1.9 million) of the population is estimated to live with diabetes and the number of deaths attributed to diabetes reached 34,262 in 2013 (IDF, 2013).

Medication non-adherence is defined as patient's failure to engage in a therapeutic regimen because of deficit in one or more of these pre-requisites: comprehension of the regimen, regard for the value of medical advice, or skills required for self-management. In both developed and developing countries, non-adherence to medication remains a significant concern for health care providers as well as patients because of its adverse consequences on therapeutic outcomes. It is significant most especially in those with chronic illnesses that involve complex and long-term medical regimen (Harold, 2000; Munger *et al.*, 2007). The drop in adherence is noted to be most dramatic after the first 6 months of therapy among patients with chronic conditions (Cramer *et al.*, 2003; Haynes *et al.*, 2002). Poor adherence to diabetes treatment recommendations would lead to manifestation of micro- and macrovascular complications and increased health care costs (Lee *et al.*, 2006; Sokol *et al.*, 2005).

There are many reasons for seeking to improve adherence in long-term therapies for chronic diseases. The benefits include: better health outcomes, improved quality of life, and improved safety for the patient as well as cost savings for all stakeholders (WHO, 2006). Accomplishment of treatment plans by patients with type 2 diabetes are essential in order to ensure normal or near normal fasting and postprandial blood glucose levels necessary for adequate control of diabetes, and subsequent reduction in mortality and reduced risk of complications (Pascal *et al.*, 2012).

1.2. Statement of the Problem

DM has become one of the most important public health challenges for the 21st century. The rate of increase in the incidence will be dramatically higher in developing countries and is paralleled by a skyrocketing increase in its chronic complications responsible for the huge premature morbidity and mortality associated with the disease (Nicolucci *et al.*, 2006). The development of long-term complications is influenced by hyperglycemia and poor control of diabetes could accelerate their progression (WHO, 1994).

Poor adherence to treatment of chronic diseases is a worldwide problem of striking magnitude. Adherence to long-term therapy for chronic illnesses in developed countries averages 50%. In developing countries, the rates are even lower given the paucity of health resources and inequities in access to health care. Poor adherence to recognized standards of diabetes care is the principal cause of development of complications of diabetes and their associated individual, societal and economic costs (WHO, 2003). However, the need to make patients adequately committed to take their medications regularly and appropriately as well as adjusting their long standing lifestyles is among the most common challenges encountered by physicians and other healthcare providers involved in diabetes care (Sharma *et al.*, 2014).

Studies investigating adherence to chronic disease treatment have evidenced that patients often discontinue their medications or even do not take them at all because they consider them ineffective or experience untoward side effects. Among diabetes patients, many believe that they do not need any drug therapies, as they have no symptoms (Grant *et al.*, 2003). Assessment of the reasons for lack of adequate treatment adherence is important

before embarking on specific interventions that may fail, if specific regimen barriers are not identified (Delamater, 2006).

Literature on adherence to treatment for chronic conditions such as diabetes call for more empirical research to assess patients' adherence to medication, identify the reasons for non-adherence, and emphasized the necessity of this information for the development of specific intervention that focus on these reasons to improve adherence (Adisa *et al.*, 2009; Dunbar-Jacob & Mortimer-Stephens, 2001; Krueger *et al.*, 2003).

To the best of our knowledge, evidence-based research on antidiabetic medication adherence and glycemic control among type 2 diabetes patients in Ethiopia is scanty. The present study was therefore carried out to assess the rate of antidiabetic medication adherence, level of glycemic control and different factors associated with both variables together with reasons for non-adherence among ambulatory type 2 diabetic patients in Tikur Anbessa Specialized Hospital (TASH). The findings would have contribution to the existing body of knowledge in the area and improve medication adherence through identifying areas of intervention.

1.3. Literature Review

1.3.1. Rate of Antidiabetic Medication Adherence

Regimen adherence problems are common in individuals with diabetes, making glycemic control difficult to attain. Because the risk of complications can be reduced by proper adherence, patient non-adherence to treatment recommendations is often frustrating for diabetes health care professionals (Delamater, 2006). Cramer (2004) conducted a systematic review on adherence with medications for diabetes at New Haven, USA and

found adherence to oral hypoglycemic agents ranged from 36-93%. Adisa *et al* (2011) conducted a cross sectional study on medication adherence among ambulatory type 2 diabetes patients at a tertiary healthcare setting in Southwestern Nigeria. It was found that approximately 60% of patients were adherent to the prescribed medications. Different rates of adherence were reported by studies conducted in Nigeria (72.5%) (Pascal *et al.*, 2012), Malaysia (47%) (Ahmad *et al.*, 2013), India (16.6%) (Sharma *et al.*, 2014), Southern California, USA (40%) (Parada *et al.*, 2012) and Brazil (78.3%) (Gimenes *et al.*, 2009).

1.3.2. Reasons for Antidiabetic Medication Non-adherence

In the literature, a number of reasons are attributed to be reasons for antidiabetic medication non-adherence. A cross sectional study by Attyia *et al* (2013) was conducted to determine the prevalence of non-adherence and to assess the causes and its effects on glycemic control, and factors affecting it among diabetic patients in Egypt. The most common reasons for low rates of adherence were found to be forgetfulness and high cost of treatment. Forgetfulness was also reported to be one of the major non-intentional reasons for antidiabetic medication non-adherence in studies made in Nigeria (Adisa *et al.*, 2009), Malaysia (Chau and Chan, 2011), India (Mukherjee *et al.*, 2013) and Southern California, USA (Parada *et al.*, 2012).

1.3.3. Adequacy of Glycemic Control

One of the primary goals of diabetes management is to lower blood glucose levels because it is well established that improved glycemic control delays the onset and retards the progression of microvascular and macrovascular complications (UKPDS 33, 1998). As such, regular testing of blood glucose is a cornerstone and achievement of adequate

glycemic control is a goal for proper diabetes care (ADA, 2014). Wabe *et al* (2011) conducted a cross sectional study in Jimma, Ethiopia to assess adherence to antidiabetic drug therapy and self management practices among type 2 diabetic patients. Adequate glycemic control was observed in 41.8% of the patients. Different figures were reported for adequate glycemic control by similar studies conducted in Southwestern Nigeria (40.3%) (Adisa *et al.*, 2011), Tanzania (32.9%) (Rwegerera, 2014), Eastern Nigeria (61.7%) (Pascal *et al.*, 2012), Malaysia (26.9%) (Chua & Chan, 2011) and India (21.4%) (Gopinath *et al.*, 2013).

1.3.4. Factors Associated with Antidiabetic Medication Non-adherence

Knowledge regarding the different factors that may influence antidiabetic medication adherence is expanding. Many factors, including demographic, cultural, socioeconomic, disease and treatment related factors have been reported in the literature. Age was one of those factors influencing adherence. The cross sectional study carried out by Ahmad *et al* (2013) in Malaysia indicated that adherence was improved with age. This report was supported by studies made in India (Sajith *et al.*, 2014), Oregon, USA (Rozenfeld *et al.*, 2008), North Carolina, USA (Patel *et al.*, 2010) where adherence was shown to increased among the elderly, and in France (Bezie *et al.*, 2006), where non-compliers were mainly younger patients. Moreover, a study emanated from Poland (Kasznicki *et al.*, 2007) demonstrated that patients above the age of 65 years were 3-fold more likely to comply with their medications.

Pill burden was another factor mentioned in the literature which has a negative impact on antidiabetic medication adherence. There is a linear trend of decreasing adherence with each increase in daily number of tablets. A cross sectional study was conducted by Shams

and Barakat (2010) to examine the rate of medication adherence and different factors affecting it among ambulatory type 2 diabetic patients in Mansoura, Egypt. The result clearly showed an inverse relationship between the rate of adherence and the number of drug therapy in patients. Similar results were reported in studies conducted in Egypt (Attiya *et al.*, 2013), Malaysia (Aziz & Ibrahim, 1999) and Scotland (Donnan *et al.*, 2002).

1.3.5. Factors Associated with Glycemic Control

Adherence to medications and lifestyle modifications are thought to drive glycemic control. Indeed, a growing body of evidence indicates that better glycemic control is achieved with increased patient adherence to antidiabetic medications, which is reported by studies made in Egypt (Attiya *et al.*, 2013), Malaysia (Chua and Chan, 2011), Nigeria (Pascal *et al.*, 2012), Tanzania (Rwegerera, 2014), Jordan (Khatab *et al.*, 2010), Virginia, USA (Schectman *et al.*, 2002), Oregon, USA, (Rozenfeld *et al.*, 2008) and Michigan, USA (Aikens & Piette, 2013). It appears, however, that the parameter of glycemic control used to define the association influences the association. For example, antidiabetic medication adherence was found to be significantly associated with better glycemic control when HbA1c but not fasting blood glucose (FBG) was used (Rwegerera, 2014).

In the literature, sex was mentioned as one of those factors influencing glycemic control. Gopinath *et al* (2013) carried out a cross sectional study among type 2 diabetes patients in India and observed that male sex was found to be a risk factor for poor glycemic control.

Low level of education was also another factor which negatively affects blood glucose control among diabetic patients. Mansour *et al* (2013) carried out a cross sectional study, to assess the determinants of loss of glycemic control among patients with diabetes in Basrah, Iraq. In the study, less educational level was found to be one of the contributing factors for worse glycemic control. The result was also supported by similar studies carried out in Jordan (Khattab *et al.*, 2010), Spain (Sastre *et al.*, 2012) and Netherlands (Goudswaard *et al.*, 2004).

Like the factors mentioned above, age was the other factor found in a number of literatures where it is reported to influence glycemic control among type 2 diabetic patients. The Iraq study conducted by Mansour *et al* (2013) found lower age to be a contributing factor to worse glycemic control. Similar results were reported by studies conducted in Netherlands (Goudswaard *et al.*, 2004), San Diego, USA (Benoit *et al.*, 2005), San Francisco, USA (Hessler *et al.*, 2011) and San Francisco, USA (Naranjo *et al.*, 2013). The study conducted in Virginia, USA by Schectman *et al* (2002) revealed that better metabolic control was independently associated with increasing age. Similar findings were also observed in another USA studies conducted by Chiu and Wray (2010), Juarez *et al* (2012) and CDC (2012).

Lifestyle modifications are very crucial for optimal management of DM. Exercising according to standard recommendations is very important not only for better glycemic control, but also for reduction of cardiovascular complications. The Jordanian study conducted by Khattab *et al* (2010) found that poor glycemic control was more common among patients who did not practice any physical activity. The US study by Chiu and Wray (2010) on the other hand revealed that an increase in physical activity was found to

be associated with a decrease in HbA1c levels of more than 1 percentage point. This was supported by studies and reports coming from USA (Marwick *et al.*, 2009), Canada (Boulé *et al.*, 2001) and USA (Van Dijk *et al.*, 2013).

Dietary restrictions to certain food items and following certain recommendations are important components of diabetic care mentioned in the literature. The Jordanian study conducted by Khattab *et al* (2010) found that poor glycemic control was more common among patients who did not follow dietary regimens. Haimoto *et al* (2009) on the other hand carried out an interventional study in Japan to assess effects of a low carbohydrate diet on glycemic control among outpatients with severe type 2 diabetes. Patients who followed a low carbohydrate diet had a remarkable reduction in HbA1c levels. Similar results were reported from studies conducted in Brazil (Davison *et al.*, 2014), Boston, USA (Mehta *et al.*, 2008) and Mexico (Castañeda-González *et al.*, 2011).

The effect of alcohol use on glycemic control is written in a number of literatures. Accordingly, alcohol consumption by diabetics can worsen blood sugar control as reported by Emanuele *et al* (1998). Ahmed *et al* (2008) also conducted a study to evaluate the association between alcohol consumption and glycemic control among adult diabetic patients in Northern California, USA. Alcohol consumption was found to have an inverse association with glycemic control.

2. OBJECTIVES

2.1. General Objective

To assess antidiabetic medication adherence and its effect on glycemic control among ambulatory type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa Specialized Hospital

2.2. Specific Objectives

- To determine the rate of adherence to antidiabetic medications
- To identify reasons contributing to antidiabetic medication non-adherence
- To assess the level of glycemic control based on fasting blood glucose measurement
- To identify factors associated with antidiabetic medication non-adherence and glycemic control

3. METHODS

3.1. Study Setting

The study was conducted in the Diabetes Clinic of TASH. TASH is a 600-bed, tertiary level and the largest general public hospital in Ethiopia. The hospital is located in Addis Ababa and affiliated with College of Health Sciences (CHS), Addis Ababa University. The hospital provides treatment for different categories of ambulatory and admitted patients coming from different corners of the country and is a major site for undergraduate and postgraduate training programs. The total number of patients seen in 2010 was 266,975. The Diabetes Clinic has endocrinologists, nurses and one pharmacist. It provides treatment to different types of endocrine disorders including all types of diabetes mellitus. The diabetic days are mainly Mondays and Wednesdays, on an average, with a footfall of 60 and 90 type 2 diabetes patients, respectively. Additionally, on average, 15 gestational diabetes patients are seen on Tuesdays.

3.2. Study Design and Period

A cross sectional study was conducted in two-phases. The first was a patient interview phase, while the second was a retrospective patient chart review. The interview and chart review were done for the same patient. Patient interviews and medical record reviews were conducted from 1st of May to 30th of June, 2014.

3.3. Sample Size and Sampling Methods

The sample size was calculated using the following single population proportion formula (Pourhoseingholi *et al.*, 2013).

$$n = \frac{Z_{\frac{\alpha}{2}}^2 P (1 - P)}{d^2}$$

(1.96)² was used for $Z_{\frac{\alpha}{2}}$, 50% for P and 5% for d and the sample size accordingly was found to be 384.16 ~ 385. The expected number of source population in the study period (N), based on the average number of patients coming to the clinic during the diabetic days was 1200 (8*60+8*90). The corrected sample size, using the following correction formula was 291.48 ~ 292, a 10% contingency yielded a final sample size of 321.2~322.

$$\text{Corrected sample size} = \frac{n \times N}{n + N}$$

Systematic random sampling method was used to recruit samples for the study in each day of the data collection process. The actual sampling fraction (k) varied in the different days of data collection as the total number of study population varied in different days. Hence, it was calculated through dividing the number of study population available each day by the maximum possible number of patients' that can be interviewed the same day. Then, every kth patient was interviewed after physician visit and his/her medical record was reviewed in the same day after the interview.

3.4. Source and Study Population

All diabetes patients attending the diabetic clinic of TASH during the study period were considered to be the source population. On the other hand, the study population was all type 2 diabetes patients attending the clinic during the study period and that fulfilled the inclusion criteria.

3.5. Inclusion and Exclusion Criteria

Inclusion Criteria:

- All patients with type 2 diabetes and on treatment with antidiabetic drugs at least for 3 months
- 18 years of age.
- Who understood Amharic language

Exclusion Criteria:

- Patients with other types of diabetes mellitus
- Non-cooperative patients

3.6. Data Collection and Analysis

3.6.1. Instruments

Structured questionnaire (Annex I): a questionnaire, containing the Morisky Adherence Predictor Scale (MAPS) was utilized to collect information necessary to assess medication adherence. The questionnaire had five parts. Part I was aimed at collecting information on basic socio-demographic variables. Part II consisted of questions required to gather information on the different patient disease related characteristics. Part III was about the different non-pharmacological approaches of diabetes care and Part IV included questions important to assess antidiabetic medication adherence, which is the MAPS. Part V included questions used to assess the reasons for medication non-adherence. MAPS is part of the WHO case management adherence guideline (CMAG) assessment tools and it is a validated scale mostly used to classify patients on medication as either high or low on motivation and knowledge domain, thus a commonly used self-report

method to assess patients' adherence to existing therapy. MAPS is a 4-item questions with dichotomous responses (Yes/No) which will enable to assess unintentional (question 1 and 2) and intentional (question 3 and 4) non-adherence behaviors.

Chart review: data abstraction format (Annex II) was prepared to extract information including fasting blood glucose (FBG), co-morbidities, diabetic complications, and prescribed medications.

3.6.2. Data Collectors Recruitment and Training

Two pharmacists were recruited as data collectors and they attended a half day short training. The training was given to them regarding the appropriate use of the data collection instruments focusing on uniform interpretation of questions, strict use of study criterion, explanation of study objectives & getting oral consents from study patients, implementation of sampling technique and confidentiality of collected data.

3.6.3. Data Quality Control

The data collection instrument which included the questionnaire and the data abstraction format was assessed by a physician and expert in the field of endocrinology for clarity and comprehensiveness of contents. Pre-testing was done among 17 (5%) randomly selected, type 2 diabetes patients, who were not included in the study, ahead of the start of the main data collection. The principal investigator, throughout the data collection process, was doing close supervision. The collected data was checked for completeness and consistency on daily basis. Maximum effort was taken in order to maintain quality of data through the different steps like data entry, analysis, interpretation and representation.

3.6.4. Data Analysis and Interpretation

Data was entered into Epi Info v-3.5.3 and analyzed using SPSS v-21. Descriptive statistics including: frequency, mean and standard deviation was used to summarize patients' baseline socio-demographic data and evaluate distribution of responses. Crude and Adjusted Odds Ratio (COR/ AOR) were calculated and 95% confidence level was used to determine factors associated with antidiabetic medications adherence and glycemic control. A p-value of 0.05 or less was considered statistically significant.

3.7. Study Variables

3.7.1. Independent

- Demographic variables (age, sex, educational status, family monthly income, marital status, occupation, profession)
- Patient characteristics (presence of co-morbidities and complications, type and number of prescribed antidiabetic drugs, duration of diabetes, knowledge about DM complications, etc)
- Antidiabetic medication adherence

3.7.2. Dependent

- Antidiabetic medication adherence
- Glycemic control

3.8. Ethical Consideration

Ethical clearance and approval of the study protocols was granted from the Ethical Review Board of School of Pharmacy. In addition the respective heads of internal medicine department and diabetic clinic permitted the study to be conducted in the clinic.

Prior to data collection, individual informed verbal consent was obtained from the study patients. Each patient was informed about the objective of the study, procedures of selection and assurance of confidentiality and their names were not registered to minimize social desirability bias and enhance anonymity. Individuals were free to withdraw from the study at any time. Patients were not faced any harm and received any monetary incentive for participating and it was solely voluntary based. The collected data was handled and secured with the principal investigator in every data collection day.

3.9. Operational Definitions

Adherent to antidiabetic medications: A patient who scored ≤ 1 for the MAPS was said to be adherent to antidiabetic medications

Non-adherent to antidiabetic medications: A patient who scored >1 for the MAPS was said to be non-adherent to antidiabetic medications

Adherent for dietary recommendations: A patient who cut off both sweet carbohydrate and fatty meals was regarded as adherent for dietary recommendations

Non-adherent for dietary recommendations: A patient who failed to cut off both sweet carbohydrate and fatty meals was regarded as non-adherent for dietary recommendations

Adherent for exercise recommendations: A patient exercised 3 days and for 150 minutes (with no more than 2 consecutive days gap in between without exercise) a week was regarded as adherent to exercise recommendations

Non-adherent for exercise recommendations: A patient who failed to exercise for 3 days and for 150 minutes (with no more than 2 consecutive days gap in between without exercise) a week was regarded as non-adherent to exercise recommendations

Treatment adherence: A patient was said to be adherent to treatment if he/she adhered to all three treatment approaches (antidiabetic medications, exercise and dietary recommendations).

Treatment non-adherence: A patient was said to be non-adherent to treatment if he/she failed to adhere to all three treatment approaches (antidiabetic medications, exercise and dietary recommendations).

Adequate knowledge about DM complications: The knowledge regarding the complications of diabetes was considered adequate when a patient could mention 3/5 complications as mentioned in the data collection instrument.

Some knowledge about DM complications: The knowledge regarding the complications of diabetes was considered some when a patient could mention 1-2/5 complications as mentioned in the data collection instrument.

No knowledge about DM complications: The knowledge regarding the complications of diabetes was considered no when a patient could not mention at least one of the five major DM complications mentioned in the data collection instrument.

Good/Adequate glycemic control: FBG \leq 110 mg/dL (UKPDS 33, 1998; UKPDS 34, 1998; AACE, 2013).

Poor/ Inadequate glycemic control: FBG $>$ 110 mg/dL (UKPDS 33, 1998; UKPDS 34, 1998; AACE, 2013).

4. RESULTS

4.1. Socio-demographic Characteristics

Females comprised 59.3% of the sex category. Majority of the patients were in the age group of 51-60 years, which accounted for 30.7%. The mean age of the studied population was 52.68 (SD=11.17) years (range 18 to 82 years). Being a House wife (98, 30.4%) accounted for the highest percentage of occupation. Patients with higher education (94, 29.2%) constituted the highest percentage of educational status category. Majority of the patients (110, 31.4%) earned low monthly family income (Table 1).

Table 1: Socio-demographic characteristic of patients with type 2 diabetes attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Frequency | Percent |
|--------------------------------------|-----------|---------|
| Sex | | |
| Male | 131 | 40.7 |
| Female | 191 | 59.3 |
| Age (Years) | | |
| 40 | 51 | 15.8 |
| 41-50 | 93 | 28.9 |
| 51-60 | 99 | 30.7 |
| 61-70 | 58 | 18.0 |
| >70 | 21 | 6.5 |
| Marital Status | | |
| Single | 42 | 13.0 |
| Married | 194 | 60.2 |
| Divorced | 39 | 12.1 |
| Widowed | 47 | 14.6 |
| Occupation | | |
| House Wife | 98 | 30.4 |
| Gov't Employee | 62 | 19.3 |
| Retired | 54 | 16.8 |
| Merchant/Trade | 48 | 14.9 |
| Unemployed | 19 | 5.9 |
| Farmer | 10 | 3.1 |
| Daily Laborer | 7 | 2.2 |
| Others* | 24 | 7.5 |
| Profession | | |
| Health Professionals | 4 | 1.2 |
| Non-health Professionals | 318 | 98.8 |
| Educational Status | | |
| Cannot Read and Write | 70 | 21.7 |
| Primary | 91 | 28.3 |
| Secondary | 67 | 20.8 |
| Higher Education | 94 | 29.2 |
| Monthly Family Income (ETB)** | | |
| Very low (445) | 99 | 30.7 |
| Low (446-1200) | 110 | 34.2 |
| Average (1201-2500) | 58 | 18.0 |
| Above average (2501-3500) | 20 | 6.2 |
| High (3501) | 35 | 10.9 |

*Carpenter, Construction, Driver, Garage (mechanic), Guard, Metal Work, Teacher working in private school

** Based on the Ethiopian Civil Service monthly salary scale for civil servants

4.2. Disease Related Characteristics

Overall, patients had been diagnosed with diabetes for an average of 10.53 (SD= 7.72) years, ranging from under five years (83, 25.8 %) through 5-10 years (114, 35.4%) to over ten years (125, 38.8%) (Figure 1).

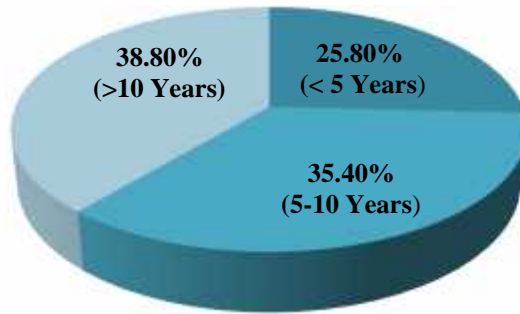


Figure 1: Duration of type 2 diabetes among patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

Two hundred and sixty nine (83.5%) patients knew at least one diabetic complication. Among this, knowledge about eye complications ranked the first among the complications, for which 95.9% of patients knew about. Overall, 18.0% and 65.5% of the respondents had some and adequate knowledge, respectively, about diabetic complications (Table 2).

Table 2: Knowledge about diabetic complications of type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Frequency | Percent |
|---|------------------|----------------|
| At least knows one Diabetic Complication | | |
| No | 53 | 16.5 |
| Yes | 269 | 83.5 |
| Knowledge on Specific Diabetic Complications (n=269) | | |
| Neuropathy | 190 | 70.6 |
| Kidney Complications | 199 | 74.0 |
| Heart Complications | 169 | 62.8 |
| Eye Complications | 258 | 95.9 |
| Diabetic Foot Ulcer | 172 | 53.4 |
| Dental Complication | 35 | 13.0 |
| Others* | 6 | 2.2 |
| Category of Knowledge about Diabetic Complications | | |
| No knowledge | 53 | 16.5 |
| Some Knowledge | 58 | 18.0 |
| Adequate Knowledge | 211 | 65.5 |

* Hearing, Mental, Infection

On patient medical record review, 192 (59.6%) patients were found to have at least one long term diabetic complication, among which retinopathy accounted for the highest percentage (136, 70.8%). Similarly, 218 (67.7%) patients had at least one co-morbid condition, hypertension being the major type of co-morbidity (188, 86.2%) (Table 3).

Table 3: Presence of co-morbidities and diabetic complications among type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Frequency | Percent |
|---|------------------|----------------|
| Complications | | |
| Diabetic Complications | | |
| Absent | 130 | 40.4 |
| Present | 192 | 59.6 |
| Specific Diabetic Complications (n=192) | | |
| Neuropathy | 73 | 38.0 |
| Nephropathy | 20 | 10.4 |
| Retinopathy | 136 | 70.8 |
| Peripheral Vascular Disease | 50 | 26.0 |
| Dental Complication | 14 | 7.3 |
| Others * | 1 | 0.5 |
| Co-morbidities | | |
| Co-morbidities | | |
| Absent | 104 | 32.3 |
| Present | 218 | 67.7 |
| Specific Co-morbidities (n=218) | | |
| Hypertension | 188 | 86.2 |
| Ischemic Heart Disease/Coronary | | |
| Heart Disease | 32 | 14.7 |
| Dyslipidemia | 55 | 25.2 |
| Obesity | 14 | 6.4 |
| Others** | 11 | 5.0 |

*Hearing problems, **HIV, Asthma

4.3. Non-pharmacological Approaches of Diabetes Care

The non-pharmacological treatment modalities practiced by patients included: diet restriction (207, 64.3%), exercise (69, 21.4%), self-monitoring of blood glucose (SMBG) (11, 7.4%), never drink alcohol regularly (235, 71.0%) and never smoke (285, 88.5%). None of the patients had dietary plans prepared with their physicians but majority of them were simply told to cut off sweet carbohydrate and fatty meals (Table 4).

Table 4: Non-pharmacological approaches of diabetic care among type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Frequency | Percent |
|---|-----------|---------|
| Diet | | |
| Dietary Approach | | |
| Cut off Sweet Carbohydrate Meals | 276 | 85.7 |
| Cut off Fatty Meals | 216 | 67.1 |
| Overall Dietary Adherence | | |
| No | 115 | 35.7 |
| Yes | 207 | 64.3 |
| Exercise | | |
| Presence of agreed Exercise plan with physicians | | |
| No | 253 | 78.6 |
| Yes | 69 | 21.4 |
| Exercising According to Plan (n=69) | | |
| No | 42 | 60.9 |
| Yes | 27 | 39.1 |
| Days per Week Doing Moderate Intense Exercise | | |
| < 3 Days | 101 | 31.4 |
| 3 Days | 220 | 68.6 |
| Duration of Moderate Intense Exercise per Week in Minutes | | |
| < 150 Minutes | 260 | 80.7 |
| 150 Minutes | 62 | 19.3 |
| Overall Exercise Adherence | | |
| No | 260 | 80.7 |
| Yes | 62 | 19.3 |
| Alcohol | | |
| Ever Drink Regularly | | |
| No | 235 | 71.0 |
| Yes | 87 | 27.0 |
| Drinking Regularly Now (n=87) | | |
| No | 85 | 97.7 |
| Yes | 2 | 2.3 |
| How much Drink Servings Per Day(n=2) | | |
| 2 for Males and 1 for Females | 1* | 50.0 |
| > 2 for Males and > 1 for Females | 1* | 50.0 |
| Cigarette | | |
| Ever Smoked | | |
| No | 285 | 88.5 |
| Yes | 37 | 11.5 |
| Smoking Now (n=37) | | |
| No | 28 | 75.7 |
| Yes | 9 | 24.3 |
| Amount of Cigarettes Per Day in Packs (n=9) | | |
| < Half a Pack | 7 | 77.8 |
| Half a Pack | 2 | 22.2 |
| Self Monitoring of Blood Glucose (SMBG) | | |
| Presence of Glucometer | | |
| No | 174 | 54.0 |
| Yes | 148 | 46.0 |
| Number of Blood Glucose Measurements Per Week (n=148) | | |
| < 1 Time Per day | 137 | 92.6 |
| 1 Time Per day | 11 | 7.4 |

*Male Sex

4.4. Rate of Antidiabetic Medication Adherence and Reasons for Non-adherence

Assessment of patients' responses to the 4-item Morisky adherence predictor scale showed that 215 (66.8%) patients were adherent to the prescribed regimen of their antidiabetic medications (Table 5).

Table 5: Summary of type 2 diabetic patients' responses to the 4-item Morisky Instrument, diabetic clinic of Tikur Anbessa specialized hospital.

| Question | Frequency (%) | |
|---|----------------------|-----------------|
| | Response | |
| | Yes (1) | No (0) |
| 1. Do you ever forget to take your antidiabetic medication (s)? | 135(41.9) | 187(58.1) |
| 2. Do you sometimes, not being careful in taking your medication (s)? | 155(48.1) | 167(51.9) |
| 3. When you feel better, do you sometimes stop taking your antidiabetic medication (s)? | 28(8.7) | 294(91.3) |
| 4. Sometimes if you feel worse when you take your antidiabetic medication (s), do you stop taking them? | 9(2.8) | 313(97.2) |
| Distribution of scores | Total (%) | |
| 0 | 123(38.2) | |
| 1 | 92(28.6) | |
| 2 | 87(27.0) | |
| 3 | 19(5.9) | |
| 4 | 1(0.3) | |
| Cut off | Frequency (%) | Category |
| ≤1 | 215 (66.8) | Adherent |
| >1 | 107 (33.2) | Non-adherent |

Up on evaluation of the reasons for antidiabetic medication non-adherence, it was identified that 100 (93.5%) patients mentioned forgetfulness as the reason for their non-adherence. For each of 29 (27.1%) and 26 (24.3%) patients, experiencing side effects and feeling well without treatment were the reasons for antidiabetic medication non-adherence, respectively. Others included busyness, fasting, sleeping and lack of access to medications (Figure 2).

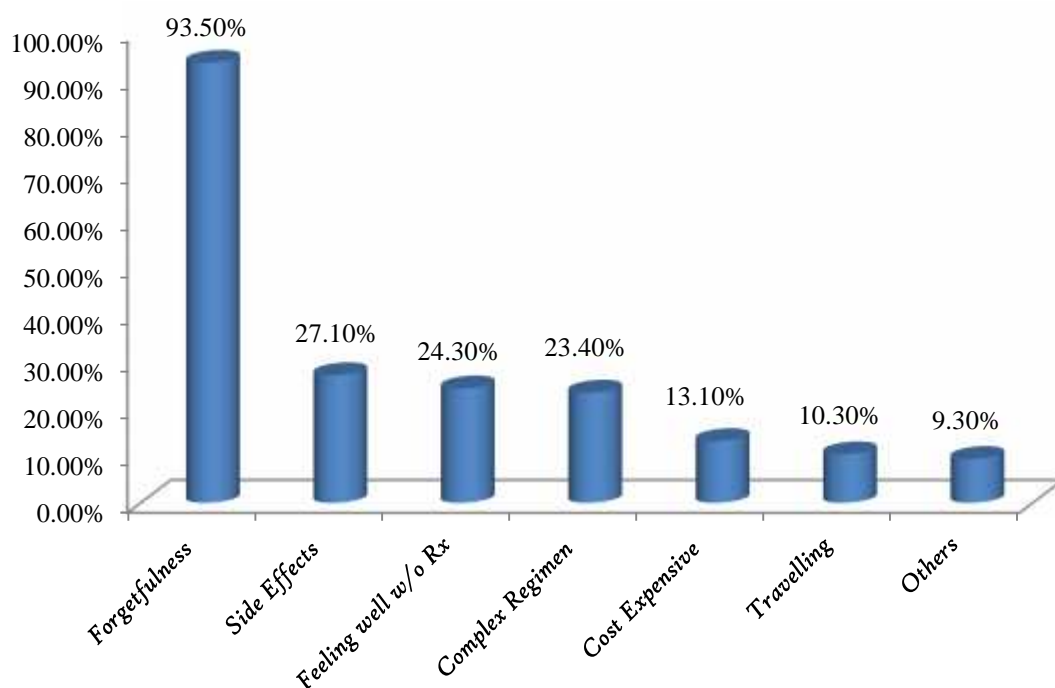


Figure 2: Reasons for antidiabetic medication non-adherence among type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

4.5. Profile of Prescribed Medications

Assessment of the prescribed antidiabetic medications among the patients revealed that Metformin (233, 72.4%) was the most commonly prescribed drug followed by Insulin (172, 53.4%) and Glibenclamide (132, 41%). One hundred and sixty eight (97.7%)

insulin prescriptions were NPH (Neutral Protamine Hagedorn) insulin. Enalapril was found to be the major type of non-antidiabetic medication followed by ASA (Acetyl Salicylic Acid) which were prescribed for 162 (50.3%) and 102 (31.7%) patients respectively. The average number of prescribed drugs per patient was 3.5 (SD= 1.7) with a range of 1-8 drugs (Table 6).

Table 6: Profile of prescribed medications for type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Frequency | Percent |
|---------------------------------|-----------|---------|
| Antidiabetic Medications | | |
| Metformin | 233 | 72.4 |
| Glibenclamide | 132 | 41.0 |
| Insulin | 172 | 53.4 |
| Type of Insulin (n= 172) | | |
| Regular | 35 | 20.3 |
| NPH | 168 | 97.7 |
| Pre-Mixed | 2 | 1.2 |
| Other Medications | | |
| Simvastatin | 45 | 14.0 |
| Lovastatin | 51 | 15.8 |
| Amitriptyline | 43 | 13.4 |
| Nifedipine | 61 | 18.9 |
| Atenolol | 35 | 10.9 |
| Hydrochlorothiazide | 59 | 18.3 |
| Enalapril | 162 | 50.3 |
| ASA | 102 | 31.7 |
| Others* | 31 | 9.6 |
| Total Number of Drugs | | |
| 1 | 29 | 9.0 |
| 2 | 80 | 24.8 |
| 3 | 53 | 16.5 |
| 4 | 73 | 22.7 |
| 5 | 45 | 14.0 |
| >5 | 42 | 13.0 |

*Amlodipine, Lasix, Phenobaritone, Warfarin, Prednisolone, ART, Carbamazapine, CPZ

4.6. Glycemic Control Using Fasting Blood Glucose

The most recent FBG value was regarded as the measure of glycemic control in this study, while the other values collected were used to see the trend of glycemic control among the study population. Accordingly, only 41(12.7%) patients attained adequate glycemic control. The mean glycemic level was 192.7 (SD= 76.5) mg/dl, with a range value of 52.0 to 444.0 mg/dl (Table 7).

Table 7: Fasting blood glucose measurements of type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| FBG Values | Frequency (%) | | Mean (SD) mg/dl | Min (Max) mg/dl |
|------------------------------------|-------------------------|----------------------------|--------------------|--------------------|
| | ≤110mg/dl (Adequate) | >110 mg/dl (Inadequate) | | |
| Most Recent Value (n=322) | 41 (12.7) | 281 (87.3) | 192.7 (76.5) | 52.0 (444.0) |
| Last appointment (n=312) | 55 (17.5) | 259 (82.5) | 180.4 (74.8) | 48.0 (427.0) |
| Second last appointment (n=310) | 55 (17.6) | 257 (82.4) | 193.2 (88.3) | 47.0 (490.0) |
| First appointment (n=318) | 7 (2.2) | 311 (97.8) | 268.8 (103.6) | 81.0 (650.0) |
| Most Recent SMBG (n=109) | 19 (17.4) | 91 (82.6) | 178.5 (69.5) | 45.0 (400.0) |

4.7. Treatment Adherence and Glycemic Control

Among 215 (66.8%) patients who reported adherent to their antidiabetic medications, 29 (13.5%) of them attained adequate glycemic control. However, among 29 (9%) of patients who adhered to all treatment recommendations (antidiabetic medications, dietary and exercise recommendations), 7(24.1%) of them attained adequate glycemic control (Table 8).

Table 8: Treatment adherence and glycemic control among type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| | Adequacy of glycemic control | | Total |
|----------------------------------|------------------------------|----------------------|--------------|
| | <i>Poor/Inadequate</i> | <i>Good/Adequate</i> | |
| Antidiabetic Medication adherent | 186 (86.5%) | 29 (13.5%) | 215 (100%) |
| Overall treatment adherent | 22 (75.9%) | 7 (24.1%) | 29 (100%) |

4.8. Factors Associated with Antidiabetic Medication Non-adherence and Glycemic Control

4.8.1. Factors Associated with Antidiabetic Medication Non-adherence

The result of univariate binary logistic regression analysis on the association between different types of independent variables and antidiabetic medication adherence showed that patients who were merchants and government employees had a significant association with their adherence condition and were about three (COR=3.1, 95% CI: 1.0-9.9) and five (COR=5.4, 95% CI: 1.7-16.9) times, respectively, more likely to adhere compared with patients who were farmers/daily laborers. Similarly, patients who had an

average family monthly income were about two (COR=2.2, 95% CI: 1.0-4.7) times more likely to adhere compared to those who had very low income and also patients who attended higher level of education were about three (COR =2.6, 95% CI: 1.3-5.1) times more likely to adhere compared to those who could not read and write (Table 9).

During univariate analysis, it was also revealed that a significant association existed between exercise adherence and antidiabetic medication adherence. Patients who exercised according to standard exercise recommendations were about two (COR= 1.9, 95% CI: 1.0-3.7) times more likely to adhere to their medications compared to their counterparts. Likewise, patients who had glucometer were about two (COR=1.9, 95% CI: 1.2-3.1) times more likely to adhere compared to those who didn't have. Furthermore, a statistically significant association was observed between total number of prescribed drugs and antidiabetic medication adherence. Patients prescribed with greater than five drugs were 0.77 (COR=0.23, 95% CI: 0.07-0.7) times less likely to adhere compared to those prescribed with only one drug (Table 9).

After controlling different demographic, economical and other factors through the use of multivariate logistic regression analysis, this study showed that only age, occupation and total number of prescribed drugs had significant association with antidiabetic medication adherence. Accordingly, patients with age group through 51-60 years were about three (AOR=2.9, 95% CI: 1.2-7.0) times more likely to adhere compared to those who were 40 years of age. On the other hand, patients who were government employees were about six (AOR=5.9, 95% CI: 1.3-25.0) times more likely to adhere compared to those who were farmers/ daily laborers (Table 9).

During a multivariate logistic regression analysis, it was also found that, patients who were prescribed with three, four, five and greater than five drugs were 0.77 (AOR= 0.23, 95% CI: 0.06-0.84), 0.75 (AOR=0.25, 95% CI: 0.07-0.92), 0.75 (AOR=0.25, 95% CI: 0.07-0.94) and 0.88 (AOR=0.12, 95% CI: 0.03-0.44) times, respectively, less likely to adhere compared to those prescribed with only one drug (Table 9).

Table 9: Multivariate logistic regression analysis result of factors associated with antidiabetic medication non-adherence among type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Adherence | | COR , 95 % CI | AOR, 95% CI |
|-----------------------------------|-----------|-----------|--------------------|--------------------|
| | No (%) | Yes (%) | | |
| Age Category | | | | |
| 40 | 20(39.2) | 31(60.8) | 1.00 | 1.00 |
| 41-50 | 31(33.3) | 62(66.7) | 1.29(0.64, 2.62) | 1.97(0.86, 4.51) |
| 51-60 | 27(27.3) | 72(72.7) | 1.72(0.84, 3.52) | 2.93(1.23, 6.98)* |
| 61-70 | 20(34.5) | 38(65.5) | 1.23(0.56, 2.68) | 2.11(0.75, 5.90) |
| 71 | 9(42.9) | 12(57.1) | 0.86(0.31, 2.41) | 1.54(0.42, 5.61) |
| Educational Status | | | | |
| Cannot Read and Write | 31(44.3) | 39(55.7) | 1.00 | 1.00 |
| Primary | 29(31.9) | 62(68.1) | 1.70(0.89, 3.24) | 1.24(0.58, 2.63) |
| Secondary | 25(37.3) | 42(62.7) | 1.34(0.67, 2.65) | 0.93(0.40, 2.18) |
| Higher Education | 22(23.4) | 72(76.6) | 2.61(1.33, 5.09) * | 1.12(0.43, 2.96) |
| Occupation | | | | |
| Farmer/Daily Laborer | 10(58.8) | 7(41.2) | 1.00 | 1.00 |
| Gov't Employee | 13(21.0) | 49(79.0) | 5.39(1.72, 16.89)* | 5.89(1.34, 24.95)* |
| Merchant | 15(31.3) | 33(68.8) | 3.14(1.00, 9.85)* | 3.76(0.90, 15.68) |
| House Wife | 35(35.7) | 63(64.3) | 2.57(0.90, 7.35) | 3.46(0.97, 12.35) |
| Retired | 18(33.3) | 36(66.7) | 2.86(0.93, 8.75) | 3.55(0.81, 15.64) |
| Unemployed | 6(31.6) | 13(68.4) | 3.10(0.79, 12.14) | 4.85(0.89, 26.40) |
| Other Occupation | 10(41.7) | 14(58.3) | 2.00(0.57, 7.06) | 2.35(0.52, 10.68) |
| Family Income Category | | | | |
| Very Low | 36(36.4) | 63(63.6) | 1.00 | 1.00 |
| Low | 45(40.9) | 65(59.1) | 0.86(0.47, 1.44) | 0.83(0.42, 1.63) |
| Average | 11(18.97) | 47(81.03) | 2.19(1.03, 4.66) * | 1.71(0.67, 4.37) |
| Above Average | 5(25) | 15(75) | 2.29(0.71, 7.36) | 1.50(0.36, 6.23) |
| High | 10(28.6) | 25(71.4) | 1.43(0.62, 3.31) | 1.08(0.35, 3.33) |
| Presence of Glucometer | | | | |
| No | 69(39.7) | 105(60.3) | 1.00 | 1.00 |
| Yes | 38(25.7) | 110(74.3) | 1.90(1.18, 3.07)* | 1.60(0.90, 2.84) |
| Total Number of Drugs | | | | |
| 1 | 5(17.2) | 24(82.8) | 1.00 | 1.00 |
| 2 | 25(31.3) | 55(68.8) | 0.46(0.16, 1.34) | 0.31(0.09, 1.04) |
| 3 | 18(34.0) | 35(66.0) | 0.41(0.13, 1.24) | 0.23(0.06, 0.84)* |
| 4 | 24(32.9) | 49(67.1) | 0.43(0.14, 1.25) | 0.25(0.07, 0.92)* |
| 5 | 15(33.3) | 30(66.7) | 0.42(0.13, 1.31) | 0.25(0.07, 0.94)* |
| >5 | 20(40.6) | 22(52.4) | 0.23(0.07, 0.72)* | 0.12(0.03, 0.44)* |
| Overall Exercise Adherence | | | | |
| No | 93(35.8) | 167(64.2) | 1.00 | 1.00 |
| Yes | 14(22.6) | 48(77.4) | 1.91(1.00, 3.65)* | 1.82(0.90, 3.66) |

*Statistically Significant: P 0.05

4.8.2. Factors Associated with Glycemic Control

After running a univariate binary logistic regression analysis; sex, age, educational status, exercise adherence and ever drink alcohol regularly were found to have a statistically significant association with glycemic control. Female patients were about two (COR=2.3, 95% CI: 1.1-5.0) times more likely to attain adequate glycemic control compared to males. Similarly, patients with age group 61-70 and 71 years were about four (COR= 4.2, 95% CI: 1.1-15.8) and five (COR= 5.0, 95% CI: 1.1-23.3) times, respectively, more likely to attain adequate control compared to those who were ≤ 40 years of age (Table 10). Patients who attended primary and secondary level of education were also about five (COR=4.8, 95% CI: 1.3-17.1) and four (COR=3.9, 95% CI: 1.0-14.9) times, respectively, more likely to attain adequate glycemic control compared to those patients who could not read and write (Table 10).

Univariate logistic regression analysis also showed that patients who adhered to standard exercise recommendations were roughly three (COR= 2.5, 95% CI: 1.2-5.2) times more likely to attain adequate glycemic control compared to their counterparts. On the other hand, patients who ever drunk alcohol regularly were 0.8 (COR= 0.2, 95% CI: 0.1-0.6) times less likely to attain adequate control compared to those who never drunk regularly (Table 10).

The present study revealed that sex, age, educational status, dietary adherence, exercise adherence and ever drink alcohol were found to be significantly associated with glycemic control during a multivariate logistic regression analysis. Accordingly, female patients were roughly three (AOR= 3.47, 95% CI: 1.2-9.9) times more likely to attain adequate glycemic control compared to males. On the other hand, those patients with ages 61-70

and 71 years were about eight (AOR=8.3, 95% CI: 1.8-39.4) and thirty one (AOR= 31.3, 95% CI: 4.1-240.9) times, respectively, more likely to attain adequate control compared to those who were ≤ 40 years of age. Patients with primary, secondary and higher educational level were about fourteen (AOR= 13.7, 95% CI: 2.9-63.6), twenty (AOR=20.1, 95%CI: 3.8-106.1) and twenty one (AOR= 20.7, 95% CI: 3.8-113.5) times, respectively, more likely to attain good blood sugar control compared to those patients who could not read and write (Table 10).

Table 10: Multivariate logistic regression analysis result of factors associated with glycemic control among type 2 diabetic patients attending the diabetic clinic of Tikur Anbessa specialized hospital.

| Variables | Glycemic Control | | COR , 95 % CI | AOR, 95% CI |
|--|------------------|-----------|--------------------|----------------------|
| | No (%) | Yes (%) | | |
| Sex | | | | |
| Male | 121(92.4) | 10(7.6) | 1.00 | 1.00 |
| Female | 160(83.8) | 31(16.2) | 2.34(1.11, 4.97)* | 3.47(1.22, 9.91)* |
| Age Category | | | | |
| 40 | 46(90.2) | 5(9.8) | 1.00 | 1.00 |
| 41-50 | 87(93.5) | 6(6.5) | 1.51(0.38, 5.95) | 2.82(0.62, 12.74) |
| 51-60 | 86(86.9) | 13(13.1) | 2.42(0.66, 8.91) | 3.22(0.76, 13.70) |
| 61-70 | 46(79.3) | 12(20.7) | 4.17(1.11, 15.75)* | 8.32(1.76, 39.35)* |
| 71 | 16(76.2) | 5(23.8) | 5.00(1.07, 23.30)* | 31.30(4.07, 240.90)* |
| Educational Status | | | | |
| Cannot Read and Write | 65(92.9) | 5(7.1) | 1.00 | 1.00 |
| Primary | 77(84.6) | 14(15.4) | 4.76(1.33, 17.07)* | 13.66(2.94, 63.55)* |
| Secondary | 57(85.1) | 10(14.9) | 3.92(1.03, 14.93)* | 20.09(3.80, 106.14)* |
| Higher Education | 82(87.2) | 12(12.8) | 3.27(0.89, 12.06) | 20.72(3.78, 113.51)* |
| Ever Drink Alcohol Regularly | | | | |
| No | 201(85.5) | 34(14.5) | 1.00 | 1.00 |
| Yes | 80(92.0) | 7(8.0) | 0.19(0.06, 0.62)* | 0.15(0.03, 0.65)* |
| Total Number of Drugs | | | | |
| 1 | 23(79.3) | 6(20.7) | 1.00 | 1.00 |
| 2 | 74(92.5) | 6(7.5) | 1.10(0.28, 4.37) | 1.30(0.26, 6.54) |
| 3 | 48(90.6) | 5(9.4) | 0.90(0.20, 4.008) | 1.26(0.22, 7.33) |
| 4 | 64(87.7) | 9(12.3) | 1.22(0.31, 4.86) | 1.56(0.29, 8.32) |
| 5 | 35(77.8) | 10(22.2) | 2.48(0.62, 9.91) | 3.16(0.59, 16.96) |
| >5 | 37(88.1) | 5(11.9) | 1.17(0.26, 5.34) | 1.18(0.19, 7.14) |
| Antidiabetic Medication Adherence | | | | |
| No | 95 (88.8) | 12 (11.2) | 1.00 | |
| Yes | 186 (86.5) | 29 (13.5) | 1.23 (0.60, 2.53) | |
| Dietary Adherence | | | | |
| No | 106(92.2) | 9(7.8) | 1.00 | 1.00 |
| Yes | 175(84.5) | 32(15.5) | 2.15(0.99, 4.69) | 3.27(1.23, 8.67)* |
| Exercise Adherence | | | | |
| No | 233(89.6) | 27(10.4) | 1.00 | 1.00 |
| Yes | 48(77.4) | 14(22.6) | 2.52(1.23, 5.15)* | 3.37(1.39, 8.20)* |

*Statistically Significant: P 0.05

5. DISCUSSION

In the present study, adherence to antidiabetic medications was observed in 66.8% of the study population. Similar studies conducted in Nigeria reported a prevalence rate of 60% (Adisa *et al.*, 2011) and 72.5% (Pascal *et al.*, 2012), to which the present study was relatively comparable with. The prevalence was greater than the result found in Malaysia 47% (Ahmad *et al.*, 2013), India 16.6% (Sharma *et al.*, 2014), and US-Mexico Border 40% (Parada *et al.*, 2012). However, it was lower than the prevalence found in the Brazilian study 78.3% (Gimenes *et al.*, 2009). A systematic review on the adherence to medication among diabetic patients showed that the average compliance to the oral hypoglycemic agents ranged from 36-93% (Cramer, 2004). Lower adherence rates to drug therapy for diabetes management is a matter of concern as disease progresses because diabetes is a progressive silent disease, and chronic complications due to poor glucose control are likely to increase with time (Gimenes *et al.*, 2009). Prevalence of adherence in the present study is below the recommended level in the literature. In the light of poor blood glucose control and alleged failure of therapeutic regimen, health providers are urged to measure diabetic patient treatment adherence. Efforts are needed to increase the medication adherence of these patients so that they can realize the full benefits of prescribed therapies. When accurate and clear information on the importance of medication adherence is provided, patients are encouraged towards self-care and adherence to drug therapy.

In this study, multivariate logistic regression analysis showed that age, occupation and total number of prescribed drugs were found to be significantly associated with antidiabetic medication adherence. As the age of patients increased from ≤ 40 years to 51-

60 years, the odds of being adherent was about three times more and this implies older patients were more likely to adhere compared to younger patients. This result was consistent with the Malaysian study (Ahmad *et al.*, 2013), which indicated that with increase in age, the adherence to antidiabetic medications improved. Similar results were also observed from studies done among diabetic patients in France (Bezie *et al.*, 2006), Poland (Kasznicki *et al.*, 2007), USA (Patel *et al.*, 2010; Rozenfeld *et al.*, 2008) and India (Sajith *et al.*, 2014) which showed that non-compliers were largely younger patients. It is possible that younger patients were less aware of their disease and were thus more likely to be more non-adherent. On the other hand, older patients showed better adherence since these people might have more severe form of the disease compared to the other age groups. This particular scenario observed in the present study emphasizes the need for educating the younger generation. Occupation was the other variable that had significant association with antidiabetic medication adherence in the present study. Patients who were government employees were more likely to engage in adherence compared to those who were farmers and daily laborers. Here, it is also possible that farmers and daily laborers might be less aware of their disease and the importance of medication adherence when compared with governmental employees and thus more likely to be more non-adherent. On the other hand, as the number of prescribed drugs increased, patients were found to be less likely to adhere to their medications. A vast number of literature supports this finding which describe as pill burden negatively affects patient adherence to treatment. A study has previously demonstrated that patients with more than two medications were more likely to be non-adherent (Aziz & Ibrahim, 1999). Similar studies also reported the number of prescribed medications to have a

significant inverse association with antidiabetic medication adherence (Attiya *et al.*, 2013; Donnan *et al.*, 2002; Shams & Barakat, 2010). According to a US survey, 50% of diabetic patients received more than seven medications in their prescription. This included antidiabetic drugs as well as other drugs to treat co-morbidities (Rubin, 2005). Thus, the drug regimen for patients with DM can become complex and adherence may definitely be a challenge for patients (Bezie *et al.*, 2006; Hankó *et al.*, 2007).

In this study, patients with poor adherence reported several reasons for not adhering to antidiabetic medications. The most common reasons were found to be forgetfulness, experiencing side effects and feeling of being well without treatment/symptom free. Most of the patients missed their antidiabetic medications due to forgetfulness which is similar to that reported in other studies (Adisa *et al.*, 2009; Attiya *et al.*, 2013; Chua and Chan, 2011; Mukherjee *et al.*, 2013; Parada *et al.*, 2012). Adherence to therapies is a primary determinant of treatment success. Failure to adherence is a serious problem, which not only affects the patient but also the health care system. Medication non-adherence in patients leads to substantial worsening of disease, death and increased health care costs. Varieties of factors are likely to affect adherence. Barriers to adherence could be classified as patient, provider and health system factors, with interactions among them. Identifying specific barriers for each patient and adopting suitable techniques to overcome them will be necessary to improve medication adherence. Health care professionals such as physicians, pharmacists and nurses have significant role in their daily practice to improve patient medication adherence (Jimmy & Jose, 2011).

The glycemic control in the present study was only adequate for 12.7% of the study population, which made the glycemic control among the study population to be very poor

and inadequate. This result was lower than the results from various studies, which reported a rate ranging from 17% to 62% (Adisa *et al.*, 2011; Chua and Chan, 2011; Gopinath *et al.*, 2013; Pascal *et al.*, 2012; Rwegerera, 2014; Wabe *et al.*, 2011). The management of DM ensures normal FBG levels necessary for short-term and long-term control and reduction of acute and chronic complications (Pascal *et al.*, 2012). Glycemic control is a strong predictor of diabetes complications, particularly microvascular complications (Ahmed *et al.*, 2008). Large-scale, randomized, prospective trials of various interventional therapies in patients with both type 1 and type 2 diabetes have clearly shown that reductions in hyperglycemia significantly decrease the microvascular complications of diabetes (ACE, 2002). Failure in achievement of clinical blood glucose targets is therefore of phenomenal importance and can lead to increased hospital visits, preventable emergency admissions and deaths (Pascal *et al.*, 2012).

During univariate logistic regression analysis, antidiabetic medication adherence was observed to be positively associated with glycemic control. However the difference was not statistically significant. This was in line with studies done in Nigeria and Tanzania (Adisa *et al.*, 2011; Rwegerera, 2014) in which the association failed to reach statistical significance. Patients, in the present study, who adhered to their antidiabetic medications, were 1.23 times more likely to attain adequate glycemic control compared to their counterparts (COR= 1.23, 95% CI: 0.6-2.5). Several studies also reported a positive association between the two (Aikens & Piette, 2013; Attiya *et al.*, 2013; Chua and Chan, 2011; Khattab *et al.*, 2010; Pascal *et al.*, 2012; Rozenfeld *et al.*, 2008; Rwegerera, 2014; Schectman *et al.*, 2002). However, the absence of a significant association in the present study did not preclude us from promoting therapeutic adherence as its benefit is a reality.

The absence of a significant association may probably be attributed to patients who claimed adherent, but may not really adhere to the regimen. Hence, multiple methods may be required to detect adherence status. In addition, patients who actually adhered to their medications might not be taking optimal pharmacological treatment (lower doses, inappropriate insulin administrations). It may also be possible that the small number of patients who attained glycemic control precluded reaching statistical significance. Some physicians who were currently involved in diabetic care in the study area also shared the probable reasons mentioned above as causes for the loss of significance association. Besides, they also mentioned the use of FBG value a limitation for the study to use it as a means of measuring the adequacy of glycemic control and it might affect the association. Otherwise, glycemic control was found to have statistically significant association with patient's sex, educational status, age, overall diet and exercise adherence and regular alcohol consumption upon multivariate logistic regression analysis. Female patients were found to have adequate glycemic control compared with male counterparts. This finding was in agreement with Nigerian and Indian studies which reported male sex as a risk factor for poor glycemic control (Adisa *et al.*, 2011; Gopinath *et al.*, 2013). In our study, educational status was shown to have a positive association with glycemic control. As patients' educational status gets increased, the likelihood of attaining adequate control was also increased. Some studies also revealed similar findings which stated that low educational status is associated with inadequate glycemic control. A study done in the Netherlands (Goudswaard *et al.*, 2004), Spain (Sastre *et al.*, 2012), Jordan (Khattab *et al.*, 2010) and Iraq (Mansour *et al.*, 2013) for instance, showed that glycemic control was worse in patients with low educational level. Education is undoubtedly essential for the

achievement of the high standards of self-management on which good diabetic control depends (Uddin *et al.*, 2001).

Regarding age, older patients were found to have higher odds of attaining adequate control than younger patients. The finding that younger age was associated with worse glycemic control is congruent with similar studies (Benoit *et al.*, 2005; CDC, 2012; Chiu & Wray, 2010; Goudswaard *et al.*, 2004; Hessler *et al.*, 2011; Juarez *et al.*, 2012; Mansour *et al.*, 2013; Naranjo *et al.*, 2013; Schectman *et al.*, 2002). It is not fully understood why younger patients have worse glycemic control than older patients. These patients have a higher lifetime risk of developing micro- and macro-vascular complications. They might be more likely to disregard diabetes as being important and could be less adherent to medication, lifestyle and diet restrictions (Toh *et al.*, 2011). On the contrary, older patients might be more motivated to take care of their diabetes and be more compliant with their medication, regular physical activity and eat healthy low-fat diet (Glasgow *et al.*, 1997). In addition to treating raised blood glucose, physicians should be alerted to commence or reinforce aggressive lifestyle intervention, lipid-lowering and anti-hypertensive therapy especially for the younger type 2 diabetic patients, which was not intensively practiced for in the DM clinic of TASH.

In the present study, patients who were adherent for both exercise and dietary recommendations were more likely to control their blood glucose levels, to the required value, compared to their respective counterparts. Similar studies also reported consistent findings which showed that exercise (Boulé *et al.*, 2001; Chiu & Wray, 2010; Khattab *et al.*, 2010; Marwick *et al.*, 2009; Van Dijk *et al.*, 2013) and dietary adherence (Castañeda-González *et al.*, 2011; Davison *et al.*, 2014; Haimoto *et al.*, 2009; Khattab *et al.*, 2010;

Mehta *et al.*, 2008) were positively associated with glycemic control. In the present study, however, in spite of the significant association, only 64.3% and 21.4% of the patients were found to be adherent to diet and exercise recommendations, respectively. The American Diabetes Association recommends that diabetes treatment should include lifestyle changes, such as a low fat, low carbohydrate and a reduced calorie diet, in order to reduce cardiovascular risk factors and increase insulin sensitivity (ADA, 2014). On the other hand, the capability of aerobic exercise to improve glycemic control in diabetes is well documented, although adherence to exercise regimens is problematic. The glucose-lowering effects of resistance training have also been documented in patients with type 2 diabetes (Gulve, 2008). Exercise improves glucose control by increasing insulin sensitivity and non-insulin dependent glucose uptake in skeletal muscle (Holloszy, 2005). There is also evidence that energy turnover (i.e., the oxidation of glucose and fatty acids) during muscle contraction is important for preventing the accumulation of metabolic intermediates that contribute to insulin resistance (Koves *et al.*, 2008). Despite the benefits in type 2 diabetes, research has noted that healthcare professionals inadequately address this issue, resulting in physical activity being an underutilized therapy (Waryasz & McDermott, 2010). Overall, dietary modifications and physical activity have been shown to be effective in reducing complications and disability and improved patients 'quality of life and life expectancy (Foreyt & Poston., 1999). Attaining adequate glycemic control is not solely dependent on adherence to medications; rather it needs a multimodal approach including adherence to dietary and exercise recommendations. Results of the present study also support this statement. Among 215 (66.8%) patients who adhered to antidiabetic medications, only 13.5% of them attained glycemic control.

However, about 24% of patients achieved adequate control among 29 (9%) patients who adhered for all treatment approaches, including medications, exercise and dietary recommendations. Thus it is a matter of necessity to educate patients with type 2 diabetes at their every visit to their physician about the importance of these lifestyle modifications.

In this study, patients who ever drunk alcohol regularly were found to have lesser odds of controlling their glycemic level compared to those who never drunk regularly. Various studies showed that alcohol consumption is inversely associated with glycemic control among diabetes patients (Ahmed *et al.*, 2008; Emanuele *et al.*, 1998). The greatest impact of alcohol is seen in those who drink heavily on a frequent basis. Heavy drinkers deplete their glycogen stores within a few hours when their diet does not provide a sufficient amount of carbohydrates. Over time, excessive alcohol consumption can decrease insulin's effectiveness, resulting in high blood sugar levels. Along with the impact on blood sugar, studies have also shown that alcohol can impact the effectiveness of the hypoglycemic medications, so extreme caution needs to be taken when consuming alcohol by anyone with diabetes (Kovacs & Stoppler, 2014). Alcohol also stimulates appetite, which can cause to overeat and may affect blood sugar control. It may also affect judgment or willpower, causing to make poor food choices. Beer and sweet wine contain carbohydrates and may raise blood sugar (WebMed, 2013). Given the tremendous disease burden and financial costs associated with diabetes complications, understanding modifiable predictors of diabetes disease course has great public health significance. Alcohol consumption is a very common, potentially modifiable behavior that may impact diabetes disease course (Ahmed *et al.*, 2008).

6. LIMITATIONS OF THE STUDY

The cross-sectional nature of the study did not allow a follow up, which would have provided a better design for identifying the problem of non-adherence and inadequacy in glycemic control. The interview used for assessing the adherence might underestimate patients' non adherence status when compared to other conventional objective methods such as pill counts or biological assays. On the other hand, the quantitative nature of the data could not properly highlight the reasons for non-adherence from the patients' perspective, which would have been better revealed by conducting in-depth interviews or focus group discussions. Since self report was used for the assessment of adherence, the present study was dependent on the assumption that patients who claimed to adhere to different treatment approaches to be actually adherent and getting optimal treatment for each approach. The study looked at only a single facility and hence caution should be exercised in extrapolating the results. The limitations of using fasting plasma glucose to assess adequacy of glycemic control was also recognized by the researchers. Admittedly, fasting plasma glucose is predictive of acute glycemia and day to day variability of blood glucose. However, studies have shown strong, significant positive correlations of HbA1c and fasting plasma glucose implying that fasting plasma glucose could be a good useful surrogate for chronic glycemia. Of great concern was non availability of HbA1c assay in the study center. However, this study gave some useful insight into the magnitude of the glycemic control among the study population and provides useful baseline information for consultative, comparative and future research purposes in the study center.

7. CONCLUSIONS

Overall, the findings from the present study indicated that the antidiabetic medication adherence of ambulatory type 2 diabetes patients in TASH is suboptimal (66.8%). Socio-economic status and pill burden had an important role in deciding adherence rate. Younger age, increased number of prescribed drugs and job being a farmer/daily laborer were significantly associated with non-adherence. Forgetfulness was the most important reason preventing optimal adherence to prescribed medications. Despite the use of multiple antidiabetic medications (both oral and insulin), only 12.7% of patients attained adequate glycemic control, which indicated that there was poor glycemic control among the study population. Younger age, male sex, low educational status, drinking alcohol regularly and each of exercise and dietary non-adherence were factors that had a significant association with poor glycemic control. The relatively higher antidiabetic medication adherence rate did not appear to have appreciable effect on patients' fasting blood glucose values, as a sizeable number of patients had a FBG above the recommended glycemic goals indicative of adequate control.

8. RECOMMENDATIONS

- ✓ Since prevalence of adherence is below that of recommended in the literature, and in the light of poor blood glucose control, health providers who are engaged in diabetic care are urged to measure diabetic patient treatment adherence, because it is key to adequate diabetes management with drugs. They also should make every effort to assist patients who wish to do so to improve adherence to their treatments.
- ✓ In view of the adverse effects of hyperglycemia leading to severe morbidity and increased mortality among the diabetic patients, a tight control of blood glucose level is mandatory. As a sizable number of patients had poor control relative to the number of patients who adhered to antidiabetic medications, the efforts of health professionals engaged in diabetic care should also gear towards ensuring patient's adherence to other aspects of diabetes management plan, including dietary and exercise adherence, so as to optimize outcome.
- ✓ Prospective studies with multiple methods of adherence assessment, involving pill count and biological assay may be required to detect patient who report adherence but who may in fact be non-adherent to antidiabetic medications.
- ✓ Mechanisms have to be devised to minimize forgetfulness which was reported as the main reason for antidiabetic medication non-adherence.
- ✓ Large studies are required to look the association between antidiabetic medication adherence and glycemetic control in the study area.

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ANNEXES

Annex I: Consent Form and Structured Questionnaire

Hello Dear Patient,

I am _____, who is part of this research project entitled with “*Assessment of antidiabetic medication adherence and its effect of glycemic control in ambulatory patients with type 2 diabetes at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia*”. The objective of the research is assessing these issues in type 2 diabetic patients like you thereby major factors contributing to antidiabetic medication non-adherence will be identified and accordingly ways of enhancing the adherence can be recommended, hence patients can improve their diabetic treatment outcomes. In order to pursue this study and attain the set specific research objectives, the research project team found important that patient interviews and record reviews be conducted. This is the reason that you and others could be candidates for the study.

It is only through chance that you became part of the study like others; otherwise, if you do not want to be part of the study, you can refuse to participate. In doing so, you will not going to lose any service that you are getting from the clinic. Once after you decided to be part of the study and in case you don't want to continue, you still have the right to get out from the study at any time you want. In taking part to this study, you are not going to be compensated too, rather the findings from this study will enable us, we hope, to improve diabetes care outcomes in general, and hence you will be benefited then.

I will be very grateful if you are going to be willing to participate in this study and hence we, together can do something positive towards diabetes care outcomes. Finally, it is my great pleasure to forward you deepest gratitude in advance for your kind cooperation you are going to have during the interview by giving your time with genuine information to me. Once again, i am assuring you, by any means, your confidentially will not be broken and be kept secret and the data generated will be used for the purpose of this research only.

Once again, thank you!

Correspondence:

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Student, AAU, CHS, SOP, Department of Pharmacology & Clinical Pharmacy

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CHAPTER 1: INTERVIEW

Part I: Socio-demographic Characteristics

| | |
|---|---|
| 1. Sex | |
| 1.1. Male <input type="checkbox"/> | 1.2. Female <input type="checkbox"/> |
| 2. Age _____ Years | |
| 2.1. < 30 <input type="checkbox"/> | 2.4. 51-60 <input type="checkbox"/> |
| 2.2. 30-40 <input type="checkbox"/> | 2.5. >60 <input type="checkbox"/> |
| 2.3. 41-50 <input type="checkbox"/> | |
| 3. Marital Status | |
| 3.1. Single <input type="checkbox"/> | 3.3. Divorced <input type="checkbox"/> |
| 3.2. Married <input type="checkbox"/> | 3.4. Widowed <input type="checkbox"/> |
| 4. Occupation | |
| 4.1. Farmer <input type="checkbox"/> | 4.5. House wife <input type="checkbox"/> |
| 4.2. Gov't Employee <input type="checkbox"/> | 4.6. Retired <input type="checkbox"/> |
| 4.3. Merchant/Trade <input type="checkbox"/> | 4.7. Others <input type="checkbox"/> Specify _____ |
| 4.4. Daily Laborer <input type="checkbox"/> | |
| 5. Profession | |
| 5.1. Health professional <input type="checkbox"/> | 5.2. Non-health professional <input type="checkbox"/> |
| 6. Educational Status | |
| 6.1. cannot read and write <input type="checkbox"/> | 6.3. Secondary (9-12) <input type="checkbox"/> |
| 6.2. Primary (1-8) <input type="checkbox"/> | 6.4. Higher Education <input type="checkbox"/> |
| 7. Monthly Family Income (in ETB) _____ | |
| 7.1. Very Low (<445) <input type="checkbox"/> | 7.4. Above Average (2501-3500) <input type="checkbox"/> |
| 7.2. Low (446-1200) <input type="checkbox"/> | 7.5. High (>3501) <input type="checkbox"/> |
| 7.3. Average (1201-2500) <input type="checkbox"/> | |

Part II: Disease related Characteristics

| | |
|--|---|
| 8. Duration of diabetes _____ Years | |
| 8.1. < 1 <input type="checkbox"/> | 8.3. >5 <input type="checkbox"/> |
| 8.2. 1-5 <input type="checkbox"/> | |
| 9. Presence of knowledge about diabetes complications | |
| 9.1. Yes <input type="checkbox"/> | 9.2. No <input type="checkbox"/> |
| 10. If yes to q. no 9, which of the following diabetes complication you know (can tick more than once) | |
| 10.1. Neuropathy <input type="checkbox"/> | 10.4. Eye complications <input type="checkbox"/> |
| 10.2. Kidney complications <input type="checkbox"/> | 10.5. Diabetic Foot Ulcer <input type="checkbox"/> |
| 10.3. Heart complications <input type="checkbox"/> | 10.6. Others <input type="checkbox"/> Specify _____ |

| | |
|--|--|
| 11. Presence of diabetic complications: Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 12. If yes to q. no 11, which diabetic complication are present (can tick more than once) | |
| 12.1. Neuropathy <input type="checkbox"/> | 12.4. Eye complications <input type="checkbox"/> |
| 12.2. Kidney complications <input type="checkbox"/> | 12.5. Diabetic Foot Ulcer <input type="checkbox"/> |
| 12.3. Heart complications <input type="checkbox"/> | 12.6. Others, if any _____ |

Part III: Non-pharmacological Approaches of Diabetes Care

| | |
|--|--|
| 13. Diet | |
| 13.1. Do you have dietary plan you set with your doctor? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 13.2. If yes to q. no 13.1, do you adhere to your plan? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 13.3. What type of dietary plan you have? | |
| 13.3.1. Cut off sweet carbohydrate meals Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 13.3.2. Cut of fatty meals (butter, cheese, fried foods, fatty cuts of red meat, egg yolks, poultry skin...) Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 13.3.3. Other plan, if any _____ | |
| 14. Exercise | |
| 14.1. Do you have exercise plan you set with your doctor? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 14.2. If yes to q. no 14.1, do you adhere to your plan? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 14.3. How many days per week you do moderate intensity exercise? _____ day(s) | |
| 14.4. How many minutes per week you do moderate intensity exercise? _____ minutes | |
| 14.5. Other forms of exercise, if any _____ | |
| 15. Alcohol | |
| 15.1. Do you ever drink alcohol regularly? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 15.2. If yes to q. no 15.1, do you currently drink alcohol on a regular basis? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 15.3. If yes to q. no 15.2, how much do you drink per day _____ | |
| 15.3.1. No more than 2 (for men) and 1 (for women) drinks <input type="checkbox"/> | |
| 15.3.2. Greater than 2 (for men) and 1 (for women) drinks <input type="checkbox"/> | |
| {NB: A drink serving is 12 ounces (340.8 ml) of beer, 5 ounces (142 ml) of wine, or 1.5 (42.6 ml) ounces of hard liquor such as scotch, gin, tequila, or vodka. 1 ounce is equal to 28.4 ml} | |
| 16. Cigarette Smoking | |
| 16.1. Do you ever smoke cigarettes? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 16.2. Are you currently a smoker? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| 16.3. If yes to q. no 16.2, how much cigarettes you smoke per day? _____ Packs | |
| 16.3.1. < half <input type="checkbox"/> | |
| 16.3.2. half <input type="checkbox"/> | |
| 16.3.3. > half <input type="checkbox"/> | |

17. Self monitoring of blood glucose (SMBG)

17.1. Do you have a glucometer? Yes No

17.2. If yes to q. no 17.1, how frequently do you perform SMBG per week? _____times

17.2.1. < 7

17.2.2. 7

Part IV: Medication adherence (4-item Morisky Adherence Predictor Scale, MAPS)
(Patients are expected to remember for the past 1 month only)

18. Do you ever forget to take your antidiabetic medication (s)? Yes No
19. Do you sometimes, not being careful in taking your antidiabetic medication (s)? Yes No
20. When you feel better, do you sometimes stop taking your medication (s)? Yes No
21. Sometimes if you feel worse when you take your medication (s), do you stop taking them? Yes No

Part V: Reasons for medication non-adherence (can tick more than once. If no single yes response for part 5 questions, go to chapter 2)

22. Which one of the following was the reason for your medication non adherence
- 22.1. Cost of medication too expensive
- 22.2. Forgetfulness
- 22.3. Feeling well without medications
- 22.4. Complex regimen
- 22.5. Physicians mode of approach
- 22.6. Lack of trust on the efficacy of medications
- 22.6.1. For metformin
- 22.6.2. For Glibenclamide
- 22.6.3. For insulin
- 22.6.4. For others, if any _____
- 22.7. Experiencing side effects
- 22.7.1. For metformin
- 22.7.2. For Glibenclamide
- 22.7.3. For insulin
- 22.7.4. For others, if any _____
- 22.8. Other reason, if any _____

Annex II: Data Abstraction Format

CHAPTER 2: CHART REVIEW

Part VI: Blood Glucose and Fasting Lipid Levels

23. Fasting blood glucose value (mg/dl)
- 23.1. Recent _____
- 23.2. On immediate previous appointment _____
- 23.3. On second previous appointment (immediately before the previous appointment) _____
- 23.4. At first follow up, after starting taking the Antidiabetic medication (s) _____

24. Result of recent self monitoring of FBG, if any (can write in ranges if there are many readings)_____

25. Recent HA1c value, if any_____

26. Recent fasting lipid profile, if any

26.1. Total cholesterol _____

26.2. HDL_____

26.3. LDL _____

26.4. TG _____

Part VII: Co-morbidities and DM Complications

27. Presence of co morbidities

27.1. Present

27.2. Absent

28. If the response for the above question is *present*, which of the following co-morbidity is present? (can tick more than once)

28.1. Hypertension

28.2. Ischemic Heart Disease

28.3. Dyslipidemia

28.4. Peripheral Vascular disease

28.5. Obesity

28.6. Others, Specify_____

29. Presence of diabetic complications

29.1. Present

29.2. Absent

30. If the response for the above question is *present*, which of the following diabetic complication is present? (can tick more than once)

30.1. Retinopathy

30.2. Any type of Neuropathy (Diabetic foot ulcer, gastroparesis, impotence ...)

30.3. Coronary Heart disease

30.4. Peripheral vascular disease

30.5. Nephropathy

30.6. Others, Specify _____

Part VIII: Medications and Dietary/Exercise Plan

31. Total number of prescribed drugs _____ (In number)

32. List of prescribed Antidiabetic medications (can tick more than once)

32.1. Metformin

32.2. Glibenclamide

32.3. Insulin

32.4. Others, Specify_____

33. Type of insulin prescribed, if any

33.1. Regular insulin

33.2. NPH insulin

33.3. Pre-Mixed

34. List of prescribed medications

34.1. Simvastatin

34.2. Lovastatin

34.3. Atorvastatin

34.4. Nifedipine

34.5. Atenolol

34.6. Hydrochlorothiazide

34.7. Enalapril

34.8. Acetyl salicylic acid

34.9. Others Specify_____

35. Non drug treatment recommendations

35.1. Dietary Plan: Present Absent

35.2. Exercise Plan: Present Absent

በቃለ መጠይቅ ለመሳተፍ የፈቃደኝነት ቃል መቀበያ ቅጽ

ወድ የቃለ መጠይቁ ተሳታፊ፤

ስሜ _____ ይባላል፡፡ “ በጥቁር አንባሳ ስፔሻላይዝድ ሆስፒታል የስኳር ህክምና ክሊኒክ በተመሳሳይ ህክምና የሁለተኛው አይነት የስኳር ህመምተኞች የስኳር መድሃኒት አወሳሰድ ዝምድና እና የደም የስኳር ቁጥጥር ላይ ያለው ተፅዕኖ መግምገም ” የተሰኘ የድህረ ምረቃ የጥናት ስራ አባል ነኝ፡፡

ይህ የጥናት ስራ አላማ በዚህ ክሊኒክ በተመሳሳይ ህክምና የሁለተኛው አይነት የስኳር ህመምተኞች የስኳር መድሃኒት አወሳሰድ ዝምድና እና የደም የስኳር ቁጥጥርን በመግምገም ህመምተኞች መድሃኒታቸውን ሁልጊዜ እንዳይወስዱ የሚያደረጉ ዋና ዋና ምክንያቶችን ይለያል፤ ህመምተኞች መድሃኒታቸውን ሁልጊዜ እንዳይወስዱ የሚረዱ የመፍትሄ ሀሳቦችን ያመለክታል፤ በመሆኑም ህመምተኞች የህክምና ሁኔታቸውን እንዲያሻሽሉ ይረዳል ተብሎ ይጠበቃል፡፡ የጥናቱን ስራ ለማካሄድና የተቀማጡ አላማዎችን ለማሳካት ይቻላል ዘንድ ህመምተኞችን ቃለ መጠይቅ ማድረግና የግል የህክምና ማህደራቸውን ማየት በማስፈለጉ እርስዎ እና ሌሎች እንደ እርሶ ያሉ ህመምተኞችን ለመሳተፍ ችለናል፡፡

እርስዎ የዚህ ጥናት አካል የሆኑትም በእድል ወይም በዕጣ ብቻ ነው፡፡ በጥናቱ መሳተፍ ካልፈለጉ ያለመሳተፍ መብት አለዎት፡፡ ባለመሳተፍዎም በዚህ ክሊኒክ የሚያገኙትን ማንኛውንም የህክምና አገልግሎት አያሰጥዎትም፡፡ ስምዎን ትዎን ገልፀው በጥናቱ መሳተፍ ከጀመሩም በኋላ መቀጠል ባይፈልጉ በማንኛውም ጊዜ ከጥናት አካልነትዎ የመውጣት መብትዎ የተጠበቀ ነው፡፡ በዚህ ጥናት በመሳተፍዎ በቀጥታ የሚያገኙት ጥቅም ባይኖርም ከጥናቱ በመገኘት ግኝቶች የስኳር ህመም ህክምና ውጤትን በተወሰነ መጠኑ ለማሻሻል እንደሚቻል በመመኘት፤ የዚያን ጊዜ እርስዎም የጥቅሙ ተቋዳሽ ይሆናሉ ብለን እናምናለን፡፡

በጥናቱ ፈቃደኛ ሆነው በመሳተፍ በጋራ ሆነን እንዲትም ብትሆን አዎንታዊ ነገር ለስኳር ህመም ህክምና ውጤት የበኩላችንን ብናበረከት ደስተኛ ነኝ፡፡ አላማውን ተረድተውና ጊዜዎችን ሰውተው በዚህ ቃለ መጠይቅ ለመሳተፍና እውነተኛ መረጃ ለመስጠት ፈቃደኛ በመሆንዎ በቅድሚያ እያላገንን ሁሉ ማንኛውም የሚሰጥ መረጃ ለምርምሩ አላማ ብቻ የሚጠይቅ ማስጠፋዊነቱም የሚጠበቅ መሆኑን ለረጋግጥልዎት እወዳለሁ፡፡

በድጋሜ አማካኝ ለሁ!

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ምዕራፍ አንድ: ቃለ መጠይቅ

ክፍል 1: አጠቃላይ መግለጫዎች

| | |
|---|--|
| 1. ያታ | |
| 1.1. ወንድ <input type="checkbox"/> | 1.2. ሴት <input type="checkbox"/> |
| 2. እድሜ _____ ዓመት (በቁጥር ይጻፍ) | |
| 2.1. < 30 <input type="checkbox"/> | 2.4. 51-60 <input type="checkbox"/> |
| 2.2. 30-40 <input type="checkbox"/> | 2.5. >60 <input type="checkbox"/> |
| 2.3. 41-50 <input type="checkbox"/> | |
| 3. የጋብቻ ሁኔታ | |
| 3.1. ያላገባ <input type="checkbox"/> | 3.3. የፈታ/ች/ <input type="checkbox"/> |
| 3.2. ያገባ <input type="checkbox"/> | 3.4. ባል የሞተባት /ሚስት የሞተችበት/ <input type="checkbox"/> |
| 4. የስራ ሁኔታ | |
| 4.1. አርሶ አደር <input type="checkbox"/> | 4.5. የቤት አመቤት <input type="checkbox"/> |
| 4.2. የመንግስት ሰራተኛ <input type="checkbox"/> | 4.6. ጠረተኛ <input type="checkbox"/> |
| 4.3. የንግድ ስራ <input type="checkbox"/> | 4.7. ሌላ ይገለፅ _____ <input type="checkbox"/> |
| 4.4. የቀን ሰራተኛ <input type="checkbox"/> | |
| 5. የሙያ ሁኔታ | |
| 5.1. የጤና ባለሙያ <input type="checkbox"/> | 5.2. የጤና ባለሙያ ያልሆነ <input type="checkbox"/> |
| 6. የትምህርት ሁኔታ | |
| 6.1. ያልተማረ/ች/ <input type="checkbox"/> | 6.3. ሁለተኛ ደረጃ (9-12) <input type="checkbox"/> |
| 6.2. አንደኛ ደረጃ (1-8) <input type="checkbox"/> | 6.4. ቴክኒክና ሙያ/ኮሌጅ/ዩኒቨርሲቲ <input type="checkbox"/> |
| 7. የቤተሰብ ወርሃዊ ገቢ (በብር) _____ (በቁጥር ይጻፍ) | |
| 7.1. በጣም ዝቅተኛ (<445 ብር) <input type="checkbox"/> | 7.4. ከአማካይ በላይ (2501-3500 ብር) <input type="checkbox"/> |
| 7.2. ዝቅተኛ (446-1200 ብር) <input type="checkbox"/> | 7.5. ከፍተኛ (>3501 ብር) <input type="checkbox"/> |
| 7.3. አማካይ (1201-2500 ብር) <input type="checkbox"/> | |

ክፍል 2: ህመም ነክ መግለጫዎች

| | |
|---|---|
| 8. የስኳር ህመምተኛ ከሆኑ ምን ያህል ጊዜ ሆነዎት? _____ (በቁጥር ይጻፍ) | |
| 8.1. < 1 ዓመት <input type="checkbox"/> | 8.3. >5 ዓመት <input type="checkbox"/> |
| 8.2. 1-5 ዓመት <input type="checkbox"/> | |
| 9. የስኳር ህመም ስለሚያስከትላቸው የጤና ችግሮች ያውቃሉ? | |
| 9.1. አዎ <input type="checkbox"/> | 9.2. አላውቅም <input type="checkbox"/> |
| 10. ለጥያቄ ቁ.9 ምላሽዎ አዎ ከሆነ የስኳር ህመም ስለሚያስከትላቸው የጤና ችግሮች ከሚከተሉት ውስጥ የትኞቹን ያውቃሉ? (ከገንዘብ መመለስ ይቻላል) | |
| 10.1. መጠዘጠዝ/መደንዘዝ <input type="checkbox"/> | 10.4. የአይን ችግር <input type="checkbox"/> |
| 10.2. የኩላሊት ችግር <input type="checkbox"/> | 10.5. የእግር ቁስለት <input type="checkbox"/> |
| 10.3. ልብና ከልብ ጋር የተያያዙ ችግሮች <input type="checkbox"/> | 10.6. ሌላ ካለ ይገለፅ _____ <input type="checkbox"/> |

11. የስኳር ህመም ያስከተለብዎት የጤና ችግር አለ? አለ የለም

12. ለጥያቄ ቁ.11 ምላሽዎ አለ ከሆነ የስኳር ህመም ያስከተለብዎት የጤና ችግር አይነት ከሚከተሉት ውስጥ የትኛው ነው?
(ከ1 በላይ መመለስ ይቻላል)

12.1. መጠዘጠዝ/መደንዘዝ 12.4. የአይን ችግር

12.2. የኩላሊት ችግር 12.5. የአግር ቁስለት

12.3. ልብና ከልብ ጋር የተያያዙ ችግሮች 12.6. ሌላ ካለ ይገለጹ _____

ክፍል 3: ከመድሃኒት ውጭ ያለ ህክምና (Non-Pharmacologic Treatment)

13. ምግብ

13.1. ከሀኪምዎ ጋር በመሆን ያዘጋጁት የአመጋገብ ፕሮግራም አለዎት? አዎ የለኝም

13.2. ምላሽዎ አዎ ከሆነ፣ በአመጋገብ ፕሮግራም መሰረት ይመገባሉ? አዎ አልመገብም

13.3. ምን አይነት አመጋገብ ይከተላሉ?

13.3.1. ጣፋጭ ምግቦችን፡ አልመገብም እመገባለሁ

13.3.2. ቅባት ነክ ምግቦችን፡ አልመገብም እመገባለሁ

(ቅባት ነክ ምግቦች ማለት ቅቤ፣ አይብ፣ የተጠበሱ ምግቦች፣ ስብ፣ የእንቁላል አስኳል፣ የዶሮ ቆዳ...)

13.3.3. ሌላ አይነት አመጋገብ የሚከተሉ ከሆነ ይገለጹ _____

14. የአካል ብቃት እንቅስቃሴ (ወከ ማድረግን ጨምሮ የተለያዩ እንቅስቃሴዎች እንደ የአካል ብቃት እንቅስቃሴ ይቆጠራሉ)

14.1. ከሀኪምዎ ጋር በመሆን ያዘጋጁት የአካል ብቃት እንቅስቃሴ ፕሮግራም አለዎት? አዎ የለኝም

14.2. ምላሽዎ አዎ ከሆነ፣ በፕሮግራም መሰረት የአካል ብቃት እንቅስቃሴ ይሰራሉ? አዎ አልሰራም

14.3. በሳምንት ስንት ቀን መካከለኛ ደረጃ ያለው የአካል ብቃት እንቅስቃሴ ይሰራሉ? _____ ቀን

14.4. በሳምንት ለምን ያህል ደቂቃ መካከለኛ ደረጃ ያለው የአካል ብቃት እንቅስቃሴ ይሰራሉ? _____ ደቂቃ

14.5. ሌላ አይነት የአካል ብቃት እንቅስቃሴ ካለ ይገለጹ _____

15. የአልኮል መጠጥ

15.1. የአልኮል መጠጥ በመደበኛነት ጠጥተው ያውቃሉ? አዎ አላውቅም

15.2. ምላሽዎ አዎ ከሆነ፣ አሁንስ በመደበኛነት የአልኮል መጠጥ ይጠጣሉ? አዎ አልጠጣም

15.3. ለተ.ቁ. 15.2. ምላሽዎ አዎ ከሆነ፣ በቀን ምን ያህል ይጠጣሉ? _____ (መጠኑ ይጻፍ)

15.3.1. እስከ 2 (ለወንዶች) ወይም እስከ 1 (ለሴቶች) መጠጥ

15.3.2. ከ 2 (ለወንዶች) ወይም ከ 1 (ለሴቶች) መጠጥ በላይ

(አንድ መጠጥ ማለት 340.8 ሚ.ሊትር ቢራ፣ 142 ሚ.ሊትር ወይን፣ 42.6 ሚ.ሊትር አረቂ፣ ስኮች፣ ጂን፣ ተኪላ፣ ቮድካ)

16. ሲጋራ

16.1. ሲጋራ አጭሰው ያውቃሉ? አዎ አላውቅም

16.2. ምላሽዎ አዎ ከሆነ፣ አሁንስ ሲጋራ ያጨሳሉ? አዎ አላጨሰም

16.3. ለተ.ቁ. 16.2 ምላሽዎ አዎ ከሆነ በቀን ምን ያህል ሲጋራ ያጨሳሉ? _____ (መጠኑ ይጻፍ)

16.3.1. < ግማሽ ፓኬት

16.3.2. ግማሽ ፓኬት

16.3.3. > ግማሽ ፓኬት

17. በግልጽ የደም የስኳር መጠን መለካትን በተመለከተ

17.1. የደም ግልጽ መለኪያ አለዎት? አላች የላችም

17.2. ምላሽዎ አዎ ከሆነ፣ በሳምንት ምን ያህል ጊዜ የደም ግልጽ መጠንዎን ይለካሉ? _____ ጊዜ (በቁጥር ይጻፍ)

17.2.1. < 7 ጊዜ 17.2.2. >= 7 ጊዜ

ክፍል 4: የስኳር መድሃኒትን ሁል ጊዜ መጠቀምን በተመለከተ፤ (4-item Modified Morisky Adherence Predictor Scale, MMAPS) (ህመምተኞች ማስታወሻ የሚጠበቅባቸው ላለፉት 4 ሳምንታት ብቻ ነው)

18. የስኳር መድሃኒትዎን ለመጠቀም ረስተው ያውቃሉ? _____ → አዎ አላውቅም

19. አንዳንድ ጊዜ የስኳር መድሃኒትዎን ለመጠቀም ጠንቃቃ ሳይሆኑ ቀርተው ያውቃሉ? _____ → አዎ አላውቅም

20. ደህና በሚሆኑ ወቅት አንዳንድ ጊዜ መድሃኒትዎን መጠቀም ያቆማሉ? _____ → አዎ አላቆምም

21. መድሃኒትዎን እየወሰዱ ህመሙ በሚባባስብዎት ወቅት መድሃኒትዎን መጠቀም ያቆማሉ? → አዎ አላቆምም

ክፍል 5: የስኳር መድሃኒትን ሁል ጊዜ ላለመጠቀም በምክንያትነት በሚጠቀሱ ነጥቦች ዙሪያ የህመምተኞች አስተያየት

22. የስኳር መድሃኒትዎን ሁል ጊዜ ላለመጠቀም እንደ ምክንያት የሚያነሱት ከሚከተሉት ውስጥ የትኛውን ነው?
(ለክፍል 4 ጥያቄዎች አንድም 'አዎ' የሚል ምላሽ ከሌለ ወደ ምዕራፍ 2 ይለፉ። ከአንድ በላይ መምረጥ ይቻላል)

22.1. መድሃኒት ለመግዛት ውስን የገንዘብ አቅም _____ →

22.2. መድሃኒት ለመጠቀም መርሳት _____ →

22.3. ያለ መድሃኒት፣ የደህንነት ሁኔታ መስማት _____ →

22.4. የተወሳሰበ እና አስቸጋሪ የመድሃኒት አጠቃቀም ሁኔታ _____ →

22.5. የሃኪሞች አቀራረብ ሁኔታ _____ →

22.6. በመድሃኒቱ ፈዋሽነት ላይ እምነት ማጣት _____ →

22.6.1. ለማትፎርሚን

22.6.2. ለግሊቤንክላማይድ

22.6.3. ለኢንሱሊን

22.6.4. ለሌላ የስኳር መድሃኒት ከሆነ ይገለጽ _____

22.7. የመድሃኒቱ የጎንዮሽ ጉዳት (Side Effect) _____ →

22.7.1. ለማትፎርሚን

22.7.2. ለግሊቤንክላማይድ

22.7.3. ለኢንሱሊን

22.7.4. ለሌላ የስኳር መድሃኒት ከሆነ ይገለጽ _____

22.8. በሌላ ምክንያት ከሆነ ይገለጹ _____