Endocrinology & Metabolic Syndrome

Woldu et al., Endocrinol Metab Synd 2014, 3:4
DOI: 10.4172/2161-1017.1000143

Research Article Open Access

Factors Associated with Poor Glycemic Control among Patients with Type 2 Diabetes Mellitus in Ambo Hospital, Ambo; Ethiopia

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Received date: Aug 22, 2014, **Accepted date:** Oct 21, 2014, **Published date:** Oct 24, 2014

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Abstract

Background: Poor and inadequate glycemic control among patients with type 2 diabetes constitutes a major public health problem and major risk factor for the development of diabetes complications. Therefore, the purpose of this study was to determine factors associated with poor glycemic control among type 2 diabetes patients attending Ambo hospital chronic care service.

Methods: A prospective cross sectional study was conducted. A 5% sample pretest was performed on randomly selected patients before the beginning of the study. A three month consecutive measurements of blood glucose was used to assess glycemic control.

Results: A total of 102 type 2 diabetes patients were interviewed and their chart was checked using a structured check list format. Of the total 102 patients, 50% had a mean FBG level of > 126 mg/dl with three month consecutive measurement resulting in poor glycemic control. We have identified that patients with age in between 51-50 yr (p=0.038) and age 61-70 yr (p=.017) were poorly managed their blood glucose level compared to the other age groups under study. The most frequent comorbidity observed over type 2 diabetes was hypertension 41(40.6%) followed by renal disease and dyspepsia with 5 and 3 patients respectively. Furthermore, patients who had hyperlipidemia and peripheral neuropathy as a comorbidities had 5 and 579 more prone to develop poor blood glucose control compared to patients with no comorbidities with 95% C.I of (1.145-20.462 and 116.8-2870), respectively.

Conclusion: The proportion of patients with poor glycemic control was high, which was nearly comparable to that reported from many countries. Age in between 51-70 yr and the presence of comorbidities like hyperlipidemia and peripheral neuropathy were associated with poor glycemic control.

Keywords: Poor glycemic control; Type two diabetes; Ambo Hospital

Abbreviations:

ADA: American Diabetes Association; CAP: Community Acquired Pneumonia; CVD: Cardiovascular Disease; DKA: Diabetes Ketoacidosis; DM: Diabetes Mellitus; DMT1: Diabetes Mellitus Type 1; DMT2: Diabetes Mellitus Type 2; FBG: Fasting Blood Glucose; HbA1c: Hemoglobin; HTN: Hypertension; NIDDM: Non Insulin Dependent Diabetes Mellitus; OAA: Oral Anti-Diabetic Agents; OGTT: Oral Glucose Tolerance Test; WHO: World Health Organization

Background

A total of 366 million people worldwide—8.3% of the global population—has diabetes mellitus, and an additional 280 million persons have impaired glucose tolerance [1]. Hence, diabetes mellitus (DM) is likely to become one of the most prevalent and economically important diseases of the 21st century largely owing to an increasing incidence of type 2 diabetes mellitus (T2DM) in the developed nations and many of the developing nations [2]. Diabetes is a chronic condition caused by a relative or an absolute lack of insulin. Its hallmark clinical characteristics are symptomatic glucose intolerance resulting in hyperglycemia and alterations in lipid and protein metabolism [3].

Poor and inadequate glycemic control among patients with T2DM constitutes a major public health problem and major risk factor for the development of diabetes complications [4]. In clinical practice, optimal glycemic control is difficult to obtain on a long-term basis because the reasons for poor glycemic control in T2DM are complex [5] Both patient and health care provider-related factors may contribute to poor glycemic control [6,7]. The American Diabetes Association (ADA) has designated HbA1c level of <7% as a goal of optimal blood glucose control [8] and the American Association of Clinical Endocrinologist has further recommended HbA1c level of < 6.5% [9].

The major risk factors in the development of T2DM are family history, obesity, race/ethnicity, age increment (>/=40 year), previous identified impaired fasting glucose or impaired glucose tolerance,

hypertension (HTN), hyperlipidemia and history of gestational DM [10]. Therefore, the purpose of the present study was to determine factors associated with poor glycemic control among T2DM patients attending Ambo hospital chronic care services.

Methods

Study area

Ambo is one of the 180 woredas in the Oromia region of Ethiopia. As part of the west Shewa zone, Ambo is located 112 Kms away from the capital of Ethiopia (Addis Ababa) towards west, on the road to Nekempt. The town has an estimated total population of 260, 193 of whom 131, 922 are men and 128, 271 are women [11]. Ambo hospital was once a mission hospital and when the missionaries left during the "Derg" regime [12].

Study period

The study period was from Oct. 15/2013 to April-15/ 2014.

Study design

A prospective cross sectional study was conducted using structured questionnaire and validated check lists to assess the factors responsible for poor glycemic control among the study participants. A three month consecutive measurements of blood glucose was used to assess glycemic control.

Population

Source of population: All patients on follow up and visiting chronic care service of Ambo hospital.

Study population: All type 2 diabetes patients on follow up and visiting chronic care service of Ambo hospital.

Inclusion criteria: All type 2 diabetes patients on follow up and visiting chronic care service of Ambo hospital during the study period.

Exclusion criteria: Uncooperative patients; If patient chart was unavailable during data collection

Sample size calculation and sampling method

A total of 102 patients were recruited using a systematic random sampling technique, considering the number of T2DM patients visiting Ambo hospital, chronic care service in weekly base.

Study variable

The main study variables included were Fasting Blood Glucose (FBG) level, disease conditions or co-morbidities, age, sex, weight, height, marital status, and educational level.

Data organization, presentation and analysis

Data was coded and entered into the Statistical Package for Social Science (SPSS) version 19 for Windows. Figures and tables were used to present the findings. Chi-square and binary logistic analysis were used to further investigate any associations. A 95% CI and p-value of <0.05 was considered to be statistically significant.

Data quality assurance

A 5% sample pretest was performed on randomly selected patients before the beginning of the study. A pretested and validated check list was used. All steps in data collection and recording were closely monitored by the principal investigator and daily collected data was, recorded and compiled for the next day study.

Ethical considerations

Ethical clearance was obtained from the Ambo University ethical review committee and official letter of co-operations was provided to Ambo hospital prior to data collection. Patient consent was obtained prior to data collection and no personal identity was disclosed. The raw data was not made available to anyone, and was not used as the determinant of any identity or subjects.

Results

Participants' characteristic

A total of 102 type 2 diabetes patients were interviewed and their chart was checked using a structured check list format. Based on the result summarized on Table 1, 48 (52.94%) of the study participants were male and majority were came from the Ambo town. The majority 33 (32.4%) were consume a minimum of 3 pint of alcohol per week and 16 (15.7%) smoke minimum of 10 cigarette per week. About 91 (89.2% of patients were on oral antidiabetic agents, and 11 (10.8%) of patients were on combination of oral antidiabetic with insulin (Table 1).

Variables		Count	percent
Sex	female	48	47.05
	male	54	52.94
Address	Rural	39	38.23
	urban	63	6176
Religion	orthodox	56	54.9
	protestant	44	43.14
	Muslim	2	1.96
Educational status	illiterate	44	43.14
	Primary school	29	28.43
	High school	14	13.72
	college	15	14.7
Alcohol use	Yes	33	32.35
	No	69	67.64
Smoking	Yes	16	15.69
	No	86	84.31
*Khat use	Yes	3	2.94
	No	99	99
Use of traditional medicines	Yes	1	0.98

	No	101	99.02

Table 1: Socio-demographic variables of type 2 diabetic patients at Ambo hospital, chronic care follow up clinic, Ambo, Ethiopia; 2014

*Khat= A tropical plant, used across east Africa and in the Middle East as a recreational and stimulant. The plant leaves chewed as either freshly or dried.

Glycemic characteristics:

The mean glycemic level of the study participant was 168.7+71.4.

Antidiabetic drugs pattern

Overall, 47% of female and 54% of male were on a different type of antidiabetic medications. Oral antidiabetic prescription was the most frequent one with almost 48% male and 41% female patient distribution. Only one male patient was identified taking insulin injection and relatively high number of female patient (5.9%) was taking the combination of insulin and OAA compared to the male patients. Considering age category, most of the antidiabetic prescription (40.2%) was prescribed for age in between 40-49. And it was this age group that was taking most of the OAA prescription (35.3%). Seventy one (69.6%) of the study participants were living with diabetes for less than 5 years while only 30.4 % were living for more than five years (Table 2).

Variables		OAA (%)	Insulin (%)	Combination of OAA plus insulin (%)	Total (%)
sex	female	42 (41.18)	0 (0)	6 (5.9)	48 (47.1)
	male	49 (48.04)	1 (0.98)	4 (3.9)	54 (52.9)
Age category	19-29	12 (11.76)	0 (0)	1 (0.98)	13 (12.7)
	30-39	22 (21.57)	0 (0)	5 (4.9)	27 (26.5)
	40-49	36 (35.29)	1 (0.98)	4 (3.92)	41(40.2)
	50-59	16 (15.69)	0 (0)	0 (0)	16 (15.7)
	>/=60	5 (4.902)	0 (0)	0 (0)	5(4.9)

Table 2: Age, Sex and antidiabetic drug distribution at Ambo hospital, chronic care follow up clinic, Ambo, Ethiopia; 2014

Most of the patients on OAA, insulin or combination of antidiabetic medications were aware and live with the disease for less than five years while still majority of the patient aware of and living with the disease for more than five years were also taking OAA (Figure 1).

Self-care management behaviors

About 60(58.82% of patients take balance diet as recommended by the nurses. Two thirds (50%) of patients did not participate in physical exercise. Eighty five (83.33%) of patients test their blood sugar regularly and, 81(79.4%) and 79(77.5%) of patients know the clinical picture of hypoglycemia and hyperglycemia respectively. Fifty two (51%) of patients either manipulate or try to control and adjust the type of diet taking (Table 3).

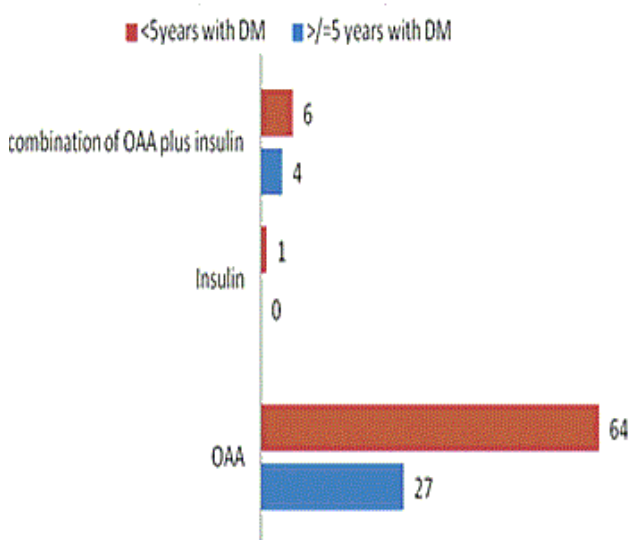

Figure 1: Types of medication used and living with T2DM in year at Ambo Hospital, 2014

Co-morbidities and duration of living with diabetes

Among all our study participants, the most frequent year of living with T2DM was four year and we had seen one patient with the maximum of year living with T2DM after first aware, that was 15 years (Figure 2). The most frequent comorbidity observed over T2DM was HTN 41(40.6%) and then followed by renal disease and dyspepsia with 5 and 3 patients respectively. In 47(46.1%) of the study participants, there was no recorded comorbidity (Figure 3).

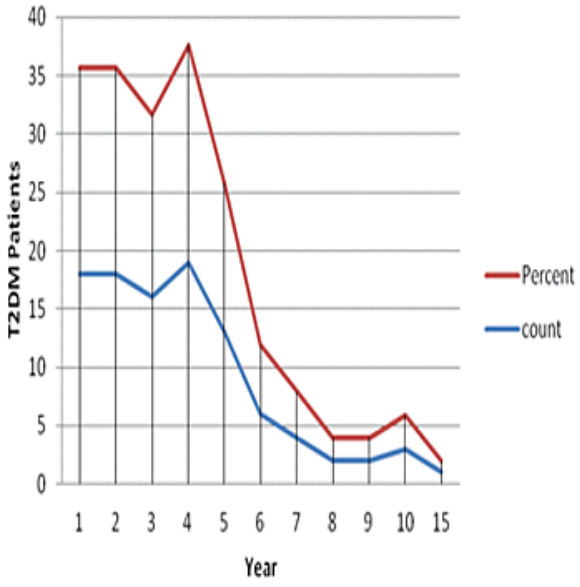

Figure 2: Duration of patients living with T2DM in year at Ambo Hospital, 2014

Variables		Count	Percent
Does he/she know when go to hypoglycemia?	Yes	81	79.4
	No	21	20.6
Does he/she know when go to hyperglycemia?	yes	79	77.5
	No	23	22.5
Does he/she take balanced diet	Yes	60	58.8
	No	42	41.2
Follow up of diabetic clinic	Yes	52	51
	No	50	49
Make physical exercise	Yes	51	50
	No	51	50
Test his/her blood sugar regularly	Yes	85	83.3
	No	17	16.7
Is he/she adhere to medications?	Yes	95	93.1
	No	7	6.86
If he/she was not adhering to the medication, what was the reason?	Lack of information	2	28.6
	hate to take life long	1	14.3
	got no improvement	2	28.6
	Economical reason	1	14.3

Table 3: Type 2 diabetes patients' responses to the self-care management questions at Ambo hospital, chronic care follow up clinic, Ambo, Ethiopia; 2014

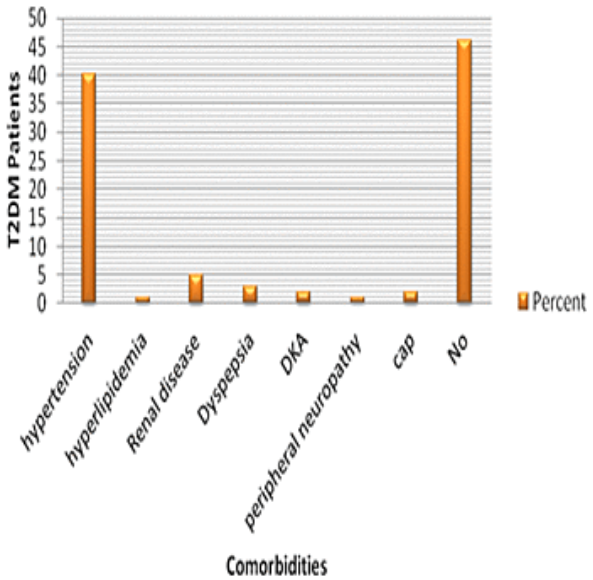

Figure 3: Proportion of patients Co morbidities

Determinants of glycemic control

In this study we have identified that patients with age in between 51-50 yr (p=0.038) and age 61-70 yr (p=.017) were poorly managed their blood glucose level compared to the other age groups under study. Furthermore, patients who had hyperlipidemia and peripheral neuropathy as a comorbidities had 5 and 579 more prone to develop poor blood glucose control compared to patients with no comorbidities with 95% C.I of (1.145-20.462 and 116.8-2870), respectively (Table 4).

Variables		A	B	Sig.	AOR	95.0% C.I. for AOR	
						Lower	Upper
Sex	Male	26	28	0.175	0.3	0.051	1.718
Age	30-40 yr	5	8	0.089	-	-	-
	41-50 yr	14	13	0.056	0.01	0.000	1.144
	51-60 yr	23	18	0.038 *	0.01	0.000	0.749
	61-70 yr	7	9	0.017 *	0.01	0.000	0.395
	>71 yr	2	3	0.276	0.1	0.002	5.794
Address	rural	24	15	0.297	.5	0.106	1.986
Alcohol use	(Yes)	16	17	0.359	.4	0.057	2.831
Smoking	(Yes)	6	10	0.404	2.7	0.264	27.102
Khat use	(Yes)	2	0	1.00	.22	0.000	.
Traditional med	(Yes)	0	1	0.999	-	0.000	.
Duration with DM	(>/= 5yr)	38	33	0.097	4	0.782	19.454
Comorbidities	Hypertension	16	25	0.253	-	-	-
	hyperlipidemia	0	1	0.032 *	5	1.145	20.462
	renal disease	3	2	1.00	-	0.000	.
	dyspepsia	1	2	0.505	.4	0.026	6.000
	DKA	1	1	0.775	.6	0.015	22.402
	peripheral neuropathy	1	0	0.045 *	579	116.8	2870
	CAP	1	1	0.999	-	0.000	.
No Comorbidities		28	19	1.00	-	0.000	.

Table 4: Binary logistic regressions showing the association between 'glycemic control' versus the different variables affecting blood glucose in patients attending Ambo hospital, chronic care follow up clinic, Ambo, Ethiopia; 2014.
A= uncontrolled blood sugar, B= controlled blood sugar

Discussion

Diabetes is estimated to be responsible for 3.96 million adult deaths per year at global level [13] and it has significant associated morbidity

and mortality. Patients with diabetes have a 2 to 4 fold increase in the risk of both cardiovascular and cerebrovascular disease, resulting in an increased mortality rate among patients with diabetes compared to the general population [14]. Therefore, glycemic control is essential in diabetes management [15].

Of the total 102 patients, 50% had a mean FBG level of > 126mg/dl with three month consecutive measurement resulting in poor glycemic control. This result was in line with other studies conducting using HbA1C as measurement of glycemic control [15-17]. However, our finding was lower than other similar study conducted in India and Ethiopia [18,19].

The mean age of patients in our study was 51.75 (SD = 10.17) years which was a bit higher than other studies [15,19]. In this study we have identified that patients with age in between 51-50 yr (p=0.038) and age 61-70 yr (p=.017) were poorly managed their blood glucose level compared to the other age groups under study. This finding was in line with the study conducted in India [18]. Other studies also found a significant relationship in age categories, smoking, duration of diabetes [20-22] and male gender[18], however, our study did not bring any significant values in the latter three. The mean FBG of three month consecutive measure in our study was 168.69 (SD=71.37) mg/dl and it was again similar to the study conducted in Ethiopia [19].

Different studies reported that the presence of diseases like coronary heart disease, neuropathy, retinopathy, renal failure and neurological disorders was associated with poor control of diabetes [13]. In our study, no association was found between HTN, renal disease, dyspepsia, DKA, or community acquired pneumonia (CAP) and glycemic control. But, other studies reported the presence of association between HTN and glycemic control [14,18]. Still other studies shown that, smoking [21] and duration of diabetes [22] could result in major adverse events in patients with type 2 diabetes.

Hyperlipidemia is common in patients with type 2 diabetes. Characteristically, they have elevated triglyceride levels, while HDL levels are low, and LDL levels are typically normal or elevated [14]. In our study, patients who had hyperlipidemia as comorbidity, have a 5 times more risk to develop poor glycemic control than patients with no comorbidities. Other studies have also shown that there was a positive correlation between total cholesterol and poor glycemic control [23]. The National Cholesterol Education Program (NCEP) also suggests that lipid-lowering treatments are essential component of diabetes care [14].

Similarly, our study also revealed that patients who had peripheral neuropathy had a 579 times more risk to develop poor glycemic control than patients with no comorbidities. Other study also tried to associate peripheral neuritis with a decrease in C-peptide secretion that accompanies beta-cell [24]. Other studies also forwarded that intensive glycemic control can reduce the incidence the neuropathy in both type 1 and type 2 diabetic subjects. Which was again supported our investigation [25].

Limitation of the Study

All the important information may not be recorded well or available as expected. For some critical cases patients' charts may be unavailable for data collection. In most of patients charts' the complication data and previous drug therapy may not be available.

Conclusions

The proportion of patients with poor glycemic control was high, which was nearly comparable to that reported from many countries. Age in between 51-70 yr and the presence of comorbidities like hyperlipidemia and peripheral neuropathy were associated with poor glycemic control. Apart from educational program that emphasizes lifestyle modification with importance of adherence to treatment regimen, appropriate management of comorbidities and special care for geriatric patients would be of great benefit in glycemic control.

Authors Contributions

MAW has made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data and has been involved in drafting the manuscript or revising it critically for important intellectual content; and has given final approval of the version to be published. CDW has made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data. JLL has been involved in drafting the manuscript or revising it critically for important intellectual content. GTT has been involved in drafting the manuscript or revising it critically for important intellectual content. GT has been involved in revising it critically for important intellectual content. HD has also been involved in revising it critically for important intellectual content.

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