

## The Situation Among Egyptian Elderly with Type 2 Diabetes; A Call for Action

Hossam Arafa Ghazi, MD

Associate Professor of Medicine, Mansoura Faculty of Medicine, Egypt

### Abstract

#### Background

Egypt is listed as one of the top ten countries with people with diabetes. Moreover, the percentage of the elderly population is growing due to the improvement of health care services. Unfortunately, there is a paucity of national data about the situation among elderly patients with type 2 diabetes (T2D).

**Objective:** The objective of this study was to estimate the gap between recommendations of guidelines and real-world data regarding control of glycaemic state and its associated risk factors.

**Patents and methods:** The current study was conducted on 207 patients with T2D aged 60 years and more, both males and females. A comprehensive geriatric assessment was done & laboratory data were collected from the participants after exclusion of other types of diabetes

**Results:** The mean age of the patients was  $66.59 \pm 4.36$  years & 132 of the participants were females. 69 % of the patients were known to have hypertension and were on regular medical treatment. Furthermore, the mean glycated hemoglobin (HbA1c) is  $8.34 \pm 1.09$  gm % & only 14% have HbA1c less than 7.5 gm %. On the other hand, just 28 patients were taking statins regularly.

**Conclusion:** The conducted study has addressed that there is a large gap between the guideline's recommendation & the situation in real life. Morbidity & mortality rates will increase among those populations and surely will increase the health burden on the health care providers in a developing country like Egypt. More education is recommended for the doctors & patients.

### Keywords

Elderly; Type 2 Diabetes; Glycated Haemoglobin; Hypertension

### Introduction

Diabetes Mellitus (DM) is considered a rapidly growing global health problem. Egypt is listed as one of the top ten countries having people living with DM. According to the International Diabetes Federation (IDF), Egypt has 10.9 million people living with diabetes (aged from 20-79 years) in 2021 and it is expected to be duplicated in 2045 by reaching about 20 million patients with DM (1). On the other hand, in the last few decades, it has been documented that there is an increase in the absolute and relative number of elderlies in Egypt. According to the Central Agency for Public Mobilization & Statistics, elderlies represented about 7% of the total Egyptian population in 2019 and by the year 2030, they are expected to represent about 12% of the total population (2). Prevalence of DM is increased with age. The lowest prevalence is recorded among adults aged between 20–24 years (2.2% in 2021). Surprisingly, the prevalence of DM is 24.0% in 2021 among adults aged between 75–79 years and is expected to reach 24.7% by the year 2045 (1).

Certainly, with the growth of the Egyptian elderlies the proportion of DM among them will increase and subsequently -if not managed properly- the morbidity & mortality rates will increase, and healthcare providers will pay more cost for that, and this is a major problem in a developing country like Egypt. With daily practice, detailed history taking with elderly patients with Type 2 diabetes (T2D) shows that many of them are not keen to monitor their blood pressure & their glycemic state nor screen for diabetes complications annually. Furthermore, the paucity of patients who are doing their routine screening tests is far from the target of most guidelines particularly the American Diabetes Association (ADA) which is a popular guideline for many physicians in Egypt. This study will explore the control of glycaemic state, blood pressure & lipid profile among Egyptian elderly patients with T2D according to ADA 2022 guidelines.

### Patients and methods

This study is a non-interventional cross-sectional study carried out on 207 Egyptian elderly patients attending geriatric & diabetes outpatient clinics of a specialized medical hospital, Mansoura University & private clinics. We included both males & females aged 60 years or older after agreeing to participate in the study.

**Exclusion criteria** were: Other types of DM rather than T2D, patients with secondary hypertension, patients who are not compliant with their treatment, patients who have a psychological disease as depression & psychosis, patients with known other endocrinal diseases like hypopituitarism, acromegaly, Cushing's disease, and patients with familial dyslipidemia. Detailed medical history was taken (including drug history & comorbid conditions).

General Examination was done for all participants including measurement of brachial blood pressure and body mass index (BMI). Glycated Haemoglobin (HbA1c), lipid profile & creatinine were measured and the estimated Glomerular Filtration Rate (eGFR) was calculated using the original Modification of Diet in Renal Disease (MDRD) 4 variable equation.

**Ethical consent:** Mansoura University's Institutional Review Board approved the study if all participants signed informed consent forms and submitted them to Mansoura University by the code (R.22.06.1726). We adhered to the Helsinki Declaration, the ethical guideline of the World Health Organization for human trials.

### Statistical analysis and data interpretation

Data were fed to the computer and analyzed using IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. Qualitative data were described using number and percent. Quantitative data were described using median (minimum and maximum) and mean, and standard deviation for parametric data after testing normality using the Kolmogorov-Smirnov test. The significance of the obtained results was judged at the (0.05) level. Chi-square test for comparison of 2 or more groups for categorical variables. Student t-test was used to compare 2 independent groups. Paired t-test to compare between before and after treatment results.

## Results

**Table (1):** Sociodemographic characteristics among patients

	Total number =207	Percentage (%)
<b>Age (Years) (mean <math>\pm</math> SD)</b>	66.59 $\pm$ 4.36	
<b>-Sex:</b>		
(a) Males	75	36.2 %
(b) Females	132	63.8 %
<b>-Special Habits:</b>		
(a) Non- Smokers	155	74.9 %
(b) Ex- Smokers	26	12.6 %
(c) Current Smokers	26	12.6 %
<b>BMI (kg/m<sup>2</sup>) (mean <math>\pm</math> SD)</b>	32.23 $\pm$ 3.78	
<b>DM duration (years) (mean <math>\pm</math> SD)</b>	12.38 $\pm$ 4.37	

**Table (2):** Lines of DM treatment among patients

Drug	Number of Patients	Percentage (%)
Metformin	138	66.7 %
Di- Peptidyl Peptidase- 4 inhibitors (DPP-4i) "Vildagliptin"	116	56.0 %
Sulfonylureas (Glimepiride or Gliclazide MR)	78	37.7 %
Sulfonylureas (Glibenclamide)	12	5.8 %
Sodium-Glucose Co Transporter 2 inhibitors (SGLT2i) including Dapagliflozin & Empagliflozin	23	11.1 %
Pioglitazone	22	10.6 %
Glucagon-Like Peptide 1 (GLP-1) Agonists	0	0 %
Insulin (Human Premixed)	27	13.0 %
Insulin (Basal Oral Regimen)	10	4.8 %
Insulin (Basal Bolus Regimen)	4	1.9 %

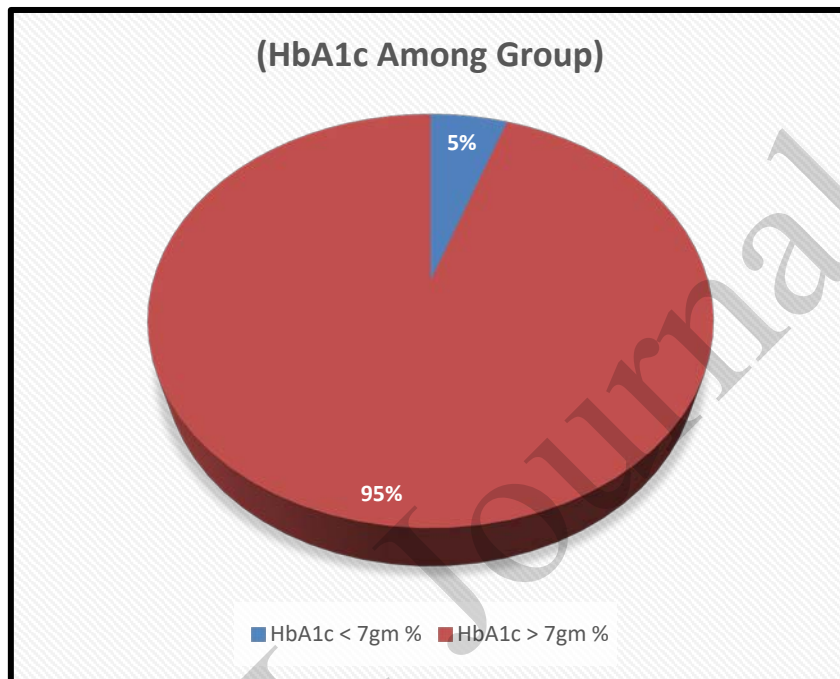
Among the studied group, 143 patients (69.1%) are known to have hypertension and take their anti-hypertensive medications regularly. Nevertheless, only 88 patients (42.5%) reached blood

pressure less than 140/90-millimetre mercury (mmHg) at the time of examination. Moreover, 19 patients (9.2 %) were first discovered to be hypertensive in the study (blood pressure is more than

140/90- mmHg at the time of examination and another 3 measures of blood pressure under the basal condition in 3 different days were required from those patients). Furthermore, only 28 patients (13.5 %) are taking statins regularly. The mean level of low-density lipoprotein (LDL) among the groups is ( $131.59 \pm 30.5$  mg/dl).

Surprisingly, only 7 patients (3.4 %) reached LDL less than 70mg/dl.

On the other hand, the mean HbA1c among the group is ( $8.34 \pm 1.09$  gm %). Majority of patients 178 patients (86%) having HbA1c 7.5 gm % and more, while only 29 patients (14%) having HbA1c less than 7.5 gm %.



**Figure (1)** Shows percentage of patients with  $HbA1c \leq 7$  gm% & patients with  $HbA1c > 7$  gm %

**Table (3)** Mean eGFR among patients & categorization according to stages of renal impairment

eGFR	Number of Patients	Percentage (%)
Mean eGFR (ml/min)	$74.51 \pm 16.92$	
eGFR $\geq 60$ ml/min	184	88.8 %
eGFR 45- 59 ml/min	8	3.8 %
eGFR 30-44 ml/min	5	2.4 %
eGFR 15-29 ml/min	10	4.8 %
eGFR < 15 ml/min	0	0 %

**Table (4):** Relation between diabetes control (at level 7gm%) and sociodemographic, clinical, laboratory findings and treatment lines among studied cases.

	HBA1c (gm%)		Test of significance
	Controlled ( $\leq 7$ ) n=11	Uncontrolled ( $\geq 7$ ) n=196	
Age (Years)	$68.09 \pm 3.83$	$66.52 \pm 4.38$	t=1.17 p=0.244

<b>-Sex</b>			
(a) Males	3 (27.3 %)	72 (36.7 %)	$\chi^2=0.404$
(b) Females	8 (72.7 %)	124 (63.3 %)	$p=0.525$
<b>-Special Habits:</b>			
(a) Non- Smokers	8(72.7)	147(75)	$\chi^2=0.411$
(b) Ex- Smokers	1(9.1)	25(12.8)	$p=0.814$
(c) Current Smokers	2(18.2)	24(12.2)	
<b>BMI (kg/m<sup>2</sup>)</b>	30.91±3.76	32.30±3.77	$t=1.12$ $p=0.264$
<b>DM duration (years)</b>	12.64±4.61	12.36±4.37	$t=0.198$ $p=0.843$
<b>Metformin</b>	10 (90.9 %)	128 (65.3 %)	$\chi^2=3.07$ $p=0.08$
<b>DPP-4i (Vildagliptin)</b>	9 (81.8 %)	107 (54.6 %)	$\chi^2=3.13$ $p=0.08$
<b>Sulfonylureas (Glimepiride or Gliclazide MR)</b>	5 (45.5 %)	73 (37.2 %)	$\chi^2=0.299$ $p=0.585$
<b>Sulfonylureas (Glibenclamide)</b>	0	12 (6.1 %)	$\chi^2=0.715$ $p=0.398$
<b>SGLT2i (Empagliflozin or Dapagliflozin)</b>	2 (18.2 %)	21 (10.7 %)	$\chi^2=0.588$ $p=0.443$
<b>Pioglitazone</b>	1 (9.1 %)	21 (10.7 %)	$\chi^2=0.029$ $p=0.865$
<b>Insulin (Human Premixed)</b>	1 (9.1 %)	26 (13.3 %)	$\chi^2=0.160$ $p=0.689$
<b>Insulin (Basal Oral Regimen)</b>	0	10 (5.1 %)	$\chi^2=0.590$ $p=0.443$
<b>Insulin (Basal Bolus Regimen)</b>	0	4 (2 %)	$\chi^{2FET}=0.229$ $p=1.0$
<b>known Hypertension</b>	6 (54.5 %)	137 (69.9 %)	$\chi^2=1.15$ $p=0.284$
<b>First Discovered Hypertension</b>	1 (9.1 %)	18 (9.2 %)	$\chi^2=0.0$ $p=1.0$
<b>Controlled Hypertension (&lt;140/90mmHg)</b>	5 (45.5 %)	83 (42.3 %)	$\chi^2=0.041$ $p=0.839$
<b>Taking Statins Regularly</b>	2 (18.2 %)	26 (13.3 %)	$\chi^2=0.215$ $p=0.643$
<b>LDL (mg/dl)</b>	127±31.31	131.86±30.52	$t=0.513$ $p=0.608$
<b>eGFR (ml/min)</b>	78.27±15.07	74.30±17.03	$t=0.757$ $p=0.450$

t: Student t-test,  $\chi^2$ =Chi-Square test, FET: Fischer exact test. P: P value (significant if <0.05)

Parameters described as mean ± SD or as number & percentage

## Discussion

DM is a state of chronic persistent hyperglycaemia due to a defect in insulin secretion from the pancreas and/or resistance to insulin receptors at the site of action (target tissue) leading to insulin resistance. This chronic hyperglycaemia is a well-known risk factor that causes damage to the small blood vessels -mainly- in the eye, nerves & kidney

(microangiopathy), and it accelerates atherosclerosis in medium-sized blood vessels (macroangiopathy). Those complications can be even seen in newly diagnosed patients with DM (3). The prevalence of DM and its associated complications is more common in the elderly in comparison to younger patients (4). Management of T2D in the elderly should have many parameters like glycaemic control, blood pressure control, weight control & control of lipid profile (5). Among the studied group, the mean duration of T2D duration is ( $12.38 \pm 4.37$  years), moreover, the mean age of our participants is ( $66.59 \pm 4.36$  years) and about 63.8 % of our participants are females. One of the characteristic features of the Egyptian elderly population is “feminization”, the sex ratio in Egypt is 83 men for 100 women (6). Furthermore, the mean BMI in our participants is ( $32.23 \pm 3.78$  Kg/m<sup>2</sup>), this matches with a study performed in Alexandria and has shown that the obesity percentage among free-living elderly females is 71.7% (7).

Regarding diabetes treatment, although metformin is listed as a first line of treatment for T2D -unless contraindicated or not tolerated- according to ADA guidelines, only about two-thirds of patients are taking it. Metformin is an effective oral antidiabetic drug, low cost, neutral on weight, potential benefits on the cardiovascular system & cause no severe hypoglycaemia (8). It is to be noted

that in our group, no one has contraindications to metformin, and many patients reported that their physicians did not advise them to take metformin with their current treatment.

About 6 % of our patients take Glibenclamide as an oral antidiabetic drug. Glibenclamide is associated with a high incidence of severe hypoglycaemia in the elderly & it has a long duration of action and should be avoided in the elderly (9,10). About 10% of our patients use pioglitazone in their treatment, according to ADA guidelines thiazolidinediones should be used with caution in the elderly and in a narrow range because it increases risks of heart failure, macular edema, osteoporosis, fracture and/or falls (10,11). It is to be noted that about three patients are taking premixed insulin with pioglitazone & this would exaggerate the side effects of both drugs. Due to its high cost, no one of our patients is on GLP-1 agonists.

The mean eGFR among the studied group is ( $74.51 \pm 16.92$  ml/min), nevertheless, only 11.1 % of the patients on SGLT2i. According to ADA 2022 (8), those patients should be on SGLT2i -unless contraindicated- as there is a well-established benefit of this class on the decreasing proteinuria & declining GFR in many major trials. This finding matches the CAPTURE trial, which is a multinational cross-sectional study conducted on 9823 patients with T2D (their mean age is about 64 years), noticed that SGLT2i is used in 16 % of the patients only, although about 1/3 of patients are eligible for those drugs (12). Most countries in the CAPTURE trial have good insurance systems -unlike Egypt-, nevertheless, similar results are noticed. More education for healthcare providers should be done about the proper positioning of this class and its benefits in decreasing the progression of Diabetic Kidney Disease (DKD).



On the other hand, in the present study, 69.1 % of the patients are known to be hypertensive & take their anti-hypertensive medications regularly. However, only 42.5 % of patients have blood pressure < 140/90 mmHg as recommended by many societies (10,13,14). Our results don't match with results reported by Ibrahim et al (15) Who reported that only 8% of patients with hypertension are controlled (blood pressure <140/90 mmHg). This may be because his results were published in 2014 & in the last few years the medical knowledge and awareness of hypertension has improved. Moreover, the availability of antihypertensive drugs has increased. Our results matched with the CAPTURE trial (12) which reported that about 70 % of the participants were known to have hypertension. In addition to that, 19 patients (9.2 %) were first discovered to be hypertensive during enrolment in the study. Surprisingly, the majority of them reported that blood pressure was not measured by their physicians during their regular visits. So, we should confirm with the junior doctors that measurement of blood pressure is essential in every visit even if the patient is asymptomatic. Another important issue in the management of T2D is the control of lipid profiles. Aging and T2D are considered 2 important risk factors for cardiovascular diseases & a lot of effort should be made to lower LDL levels (14). According to the guidelines of ADA 2022, LDL level should be -at least- less than 70mg/dl using moderate to high-intensity statins (16). In the conducted study, only 13.5 % are taking statins regularly. The mean LDL level is (131.59 + 30.5mg/dl) & only 3.4 % of patients have LDL levels less than 70 mg/dl. Similar results have been reported from the EUROASPIRE IV trial, which is a large multicentric cross-sectional study conducted in 24 European countries and

concluded that among patients with coronary heart disease, 79 % of males & 84% of females have LDL levels ( $\geq 1.8$  mmol/L i.e., about 69 mg/dl) (17).

Regarding the control of diabetes, which is the main pillar in the management of T2D, according to the recommendations of ADA and the American Geriatrics Society (9,10), the target HbA1c among healthy elderly with few comorbidities and good functional status is from 7 to 7.5 gm%. Majority of patients in the current study (86%) have HbA1c 7.5 gm % and more, while only 5% have HbA1c less than 7 gm %. These results were supported by similar studies conducted in Egypt to assess the glycaemic control. A study conducted in 2019 on 200 Egyptian patients with DM concluded that only 7 % of patients have HbA1c less than 7 gm % (18). On the other hand, our results disagree with the results of the CAPTURE trial which reported that the mean HbA1c among patients was 7.3 gm% (12). This difference in the results may be attributed to the difference between socioeconomic level & strength of the health insurance system in Egypt & countries in the CAPTURE trial. More actions are needed to reduce HbA1c among patients with T2D because the higher HbA1c is associated with higher rates of micro and macrovascular complications (3).

Lastly, it was noticed that in the well-controlled group, most of the patients used oral drugs with a lower percentage of sulfonylureas. Moreover, only one patient is using insulin in a well-controlled group in comparison to 40 patients in the uncontrolled group. These results agree with the ADA guidelines that recommend minimizing the use of hypoglycaemic drugs like sulfonylureas & insulin and trying to simplify the insulin regimens as much as possible (10).

## CONCLUSION

The conducted study has addressed that there is a large gap between the guideline's recommendation & the situation in real life. This will increase the morbidity & mortality rates among those populations and surely will increase the health burden on the health care providers in a developing country like Egypt. More education is recommended for the doctors about the importance of glycaemic control, blood pressure control and giving statins inappropriate doses to reach the target LDL level as possible. Furthermore, raising the knowledge about the use of drugs with benefits on the kidney & cardiovascular system should be done. Finally, patient awareness about regular screening of diabetes complications & adherence to the medications should be done.

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