Impact of Age, Gender, Diabetes Mellitus Duration and Body Mass Index on Metabolic Control of Type 2DM among a Group of Jordanian Patients

Fares Haddad MD, FRCP, Khaldon Al-Sarihin MD**

ABSTRACT

Objectives: To assess the impact of age, gender, duration of diabetes and body mass index confounders on diabetes control among a Jordanian cohort of T2DM at the Endocrine Clinic in King Hussein Medical Center.

Methods: Patients were selected over 18 months from outpatient clinic at King Hussein Medical Center in Amman-Jordan. Diabetes control assessed by mean of latest 3 HbA1c and fasting blood sugar. Patients were divided in 2 groups according to age (<55 years Vs >55 years), gender, duration (<10 years Vs >10 years) and BMI (normal, overweight, and obese according to WHO criteria). Statistical analysis is performed using SPSS11.5.Good diabetes control is assessed according to American Diabetes Association criteria

Results: A total of 405 patients were selected (223 males, 182 females). 115 patients (28.4%) were having a good control with HbA1c <7%.; 25.6% of males and 31.9% of females were having good control (P value =0.161).

There was no difference in diabetes control of those <55 years (n=183) Vs those >55 years (n=222) (29%vs.28%; p=0.812). Females in both age groups were having non statistically significant better control than males. Of those with DM duration <10 years (n=242); 34.7% were having good control vs. only 19% for those > 10 years duration (n=163) {P-value=0.001, RR=1.83, OR=2.26}. Females were again having a better diabetic control in both duration groups, p=0.024.

There was no statically significant difference in diabetic control in all BMI categories studied. Thirty percent of overweight patients were having good control Vs <20% in normal and obese patients.

The mean HBA1c in males was 8.1±1.7% Vs 7.9±1.5% in females. For the group <10 year, HBA1c was 7.75±1.5% Vs 8.32±1.54% in those >10 year. The mean HBA1C of the group aged< 55 years was 8.1±1.8 Vs 7.9±1.5 in those >55 years of age.

Conclusion: In this Jordanian group with T2DM the diabetic control was modest at 28.4%. Females were having a better diabetic control at all categories. Diabetes duration less 10 years was the only indicator of adequate control of diabetes.

Key words: BMI, Diabetes control, Diabetes duration, Gender, T2 diabetes.

JRMS September 2012; 19(3): 33-38

Introduction

Diabetes is associated with a reduced lifespan, largely as a consequence of cardiovascular disease.

Gender differences in diagnostic procedures, risk factor control and treatment profile of cardiovascular disease have been the subject of several investigations.[1-3] Less is known, however, about corresponding gender differences in the treatment of patients with diabetes.[4]

From the published literature we know that gender

*From the Department of Internal Medicine, Endocrine Division, King Hussein Medical Center, Amman-Jordan
Correspondence should be addressed to Dr. F. Haddad, P. O. Box 967 Amman 11118 Jordan, E mail: haddf@hotmail.com
Manuscript received February 13, 2012. Accepted May 10, 2012

differences in adherence to diet and diabetes treatment may be attributed, in part, to gender differences in symptoms among young type 1 diabetics from urban environment with poor metabolic control. Interventions targeting these symptoms may be necessary to improve adherence and HbA1c control in male as well as female patients.[5,6]

Male and female diabetic patients differ in respect of biological, social, as well as behavioral factors, frequently depending on age.[7]

In the UKPDS it was shown that the HbA1c tend to increase with the duration of diabetes losing it control,[8] several studies also showed differences in diabetes control among different ethnic groups ,genders and obese patients tend to have poorer diabetes control.[8,9]

It is known that improved glycemic control improves microvascular outcomes, less is known about the factors that influence control. Harris *et al*.[10] examined racial and ethnic differences in glycemic control in patients with Type 2 diabetes using the Third National Health and Nutrition Examination Survey (NHANES III) and found that black women, Mexican-American men, those treated with insulin or oral antiglycemic medications, and patients over 60 years of age had poorer glycemic control. Shorr *et al*.[11] studied the relationship between age and glycemic control and found no significant differences between age groups. Nichols *et al*.[12] found that age, body mass index (BMI) and emotional distress were significantly related to glycemic control. Blaum *et al*.[13] found that disease duration; C peptide levels, poor self-care, and failure to receive diet recommendations were related to control in a mostly white, primary care population in USA.

Diabetes mellitus is a prevalent chronic disease in Jordan, the recent estimates are of 17.1% of the population are diabetics and 7.8% are having impaired fasting glucose.[14] Therefore diabetes constitutes a medical and economic burden. Studies of the factors that have an impact on diabetic control are in Jordan; only one study showed that low BMI, shorter duration of diabetes and higher baseline HbA1c were related to diabetes control after 12 months of follow up period.[15]

The aim of this study is to assess the impact of age, gender, duration of diabetes and body mass index confounders on diabetes control among a Jordanian cohort of T2DM at the Endocrine Clinic in King Hussein Medical Center.

Methods

This study was conducted by recruiting patients who attended the diabetes clinic who were randomly selected over 18 months from outpatient Endocrine clinic of endocrine division at King Hussein Medical Center in Amman-Jordan from January 2009 till June 2010.

The inclusion criteria included all patients with type 2 diabetes who attended on each Tuesday of each week who have at least 2-3 HbA1c, lipid profile and Fasting Blood Sugar (FBS) performed over previous year. Patients with type 1 diabetes were not included.

This study was approved by the Royal Medical services Ethical Committee. Verbal consent was obtained from all participants.

The patients, after history taking, were assessed for demographic features, anthropometric measures and associated conditions; physical examination was performed by an endocrinologist.

Blood was drawn in a fasting stat for FBS, lipid profile, kidney function and liver function tests, and HbA1c, tests were performed using automated multichannel analyzer (Hitachi 917, Modular type)

Diabetes control was finally expressed as the mean of latest three readings of HbA1c and FBS results over the follow-up period of 14±2 months.

The American Diabetes Association (ADA) criteria for adequate diabetes control for fasting blood sugar (FBS <100mg) and HbA1c (<7%) was adopted.[16]

Patients were divided into 2 groups according to age (<55 years Vs >55 years), gender, duration (<10 years Vs >10 years) and three groups of Body Mass Index {BMI}: normal, overweight, and obese according to WHO criteria.[17]

Statistical analysis Intra and inter group comparisons were performed in all groups studies using z static for difference between two percentages, t test for comparing means and univariate and multivariate analyses for prediction and calculating Odd Ratio (OR) and Relative Risk (RR) performed using SPSS 11.2 and EPI Info 6 2005, values were expressed as means and Standard Deviation (SD); a p value < 0.05 was considered as significant.

Results

A total of 405 patients were selected; there were 223 males and 182 females, the mean age is 54.6±10.45 years (M vs. F, 53.9±11.4 vs. 55.5±9.2; p= 0.065). Diabetes duration was 10.3 ±7.4 (M vs. F: 10.6 ±7.8 vs. 9.98 ±6.9; p= 0.2). Body Mass Index (BMI kg/m^2) was 30.4 ±4.9 (M vs. F: 29 ±4.3 vs. 32.1 ±5.1; p<0.00003).

Table I: Demographic features mean values of HbA1c and fasting blood sugar among the study group

Mean ±SD	n=405
Age (year)	54.6 ± 1.4
BMI kg/m^2	30.4 ± 4.9
Duration (years)	10.3 ± 7.4
Smoker %	24.4%
HbA1c (%)	7.83 ± 1.99
FBS (mg/dl)	193.5 ± 84.8

Table II: Percentage of diabetic control (HbA1c ≤ 7%) according to gender, age, duration and BMI criteria

	Male	Females	All	P value (M vs. F)
HbA1c ≤ 7%	25.6%	31.9%	28.4%	0.161
Age				
<55 years	25.2%	33.8%	29%	0.82
> 55 years	25.8%	30.4%	27.9%	
P value	0.9	0.6	0.82	
Duration				
<10 years	31.3%	38.6%	34.7%	0.23
>10 years	17.9%	20.6%	19.1%	0.66
P value	0.024	0.012	0.001*	
BMI				
Normal	14.3%	4.8%	19%	0.52
Overweight	17%	12.8%	29.8%	0.11
Obese	11.8%	17.9%	29.7I%	0.47
P value	0.07	0.07	0.069	

Table III: mean HbA1c (±SD) according to gender, age, duration and BMI criteria

	Male n=223	Females n=182	All	P value
HbA1c	8.1 ±1.73	7.87±1.53	7.9±1.99	0.177
Age				
<55 years	8.3±1.9	7.8±1.6	8.07±1.79	0.00
> 55 years	7.89±1.55	7.9±1.47	7.9±1.51	0.001
P value	0.11	0.65	0.32	
Duration				
<10 years	7.83±1.79	7.65±1.53	7.75±1.67	<0.001
>10 years	8.4±1.6	8.2±1.46	8.37.75±1.5	0.029
P value	0.02	0.012	0.001	
BMI				
Normal	8±1.7	7.9±1.39	7.98±1.62	0.9
Overweight	8.1±1.77	7.6±1.3	7.9±1.64	0.07
Obese	8.04±1.75	7.96±1.65	7.99±1.69	0.7
P value	0.75	0.38	0.77	

Demographic characteristics and mean levels of HbA1c and fasting blood sugar (FBS) are shown in Table I.

One hundred and fifteen patients (28.4%) were having a good diabetes control with HbA1c <7%; 25.6% of males and 31.9% of females were having good control (P value =0.161).

In a univariate analysis there was no statistically significant difference in diabetes control of those <55 years (n=183) Vs those >55 years (n=222) (29%vs.28%; p=0.812). When gender groups were considered; Females in both age groups have no statistically significant better control than males (Table II).

Of those with DM duration <10 year (n=242); 34.7% were having good control vs. only 19% for those > 10 years duration (n=163) {P-value=0.001, RR=1.83, OR=2.26}. Females again were having a better diabetic control in both duration groups, p=0.024 as demonstrated in Table II.

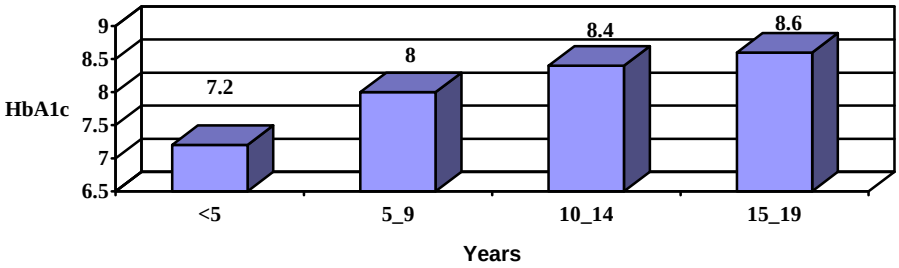

Fig. 1: Mean HbA1c (%) according to diabetes duration

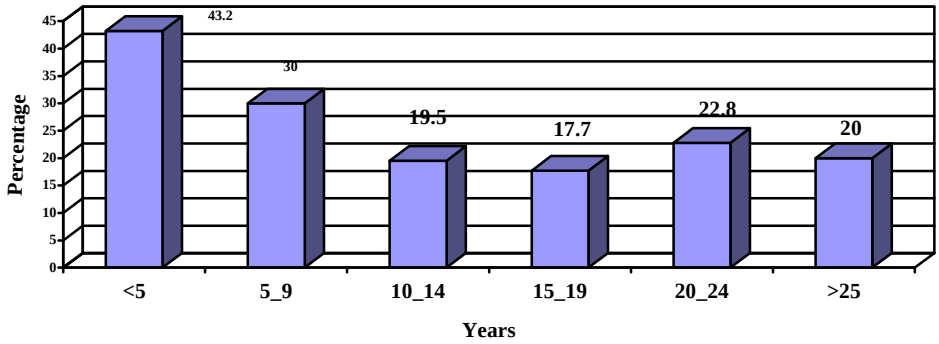

Fig. 2: Frequency of diabetes control according to duration of diabetes

There was no statistically significant difference in diabetic control in all BMI categories studied. Thirty percent of overweight patients were having good control Vs <20% in normal and obese patients. (Table III)

The mean HBA1c in males was 8.1±1.7% Vs 7.9±1.5% in females. For the group <10 years, HBA1c was 7.75±1.5% Vs 8.32±1.54% in those >10 year. The mean HbA1C of the group aged< 55 years was 8.1±1.8 Vs 7.9±1.5 in those >55 years of age (see Table III).

The course of mean HBA1c is illustrated in Fig. 1 where HBA1c increased with increasing duration of DM, while diabetic control dropped with increasing age (Fig. 2).

Discussion

Diabetes control is of paramount importance due to strong consensus that excellent control improves micro-vascular complication in T2DM.[18] Identifying demographic, psychological and treatment factors that have an impact on diabetes control may improve outcome by allowing better selection of patients to compensators interventions.[12]

Diabetes control expressed as HbA1c ≤ 7% was achieved in 28.4% of the cohort studied; females showed non significantly better control than males (31.9 % vs. 25.6% p: 0.162), these findings come in accordance to other loco- regional studies form Jordan;[15] Saudi Arabia 27%[19] and Kuwait.[20] However these figures are lower than that reported in USA and Europe.[8,21,22]

Diabetes control showed a steady worsening expressed by increasing HbA1c over follow up period since diagnosis and with increasing age (Fig. 1 and 2) that is in keeping with many studies including UKPDS33 and Benoit *et al*.[8,18] The decline in β cell function with type 2 diabetes progressions over time is the explanation of this deterioration in diabetes control that has an impact on patients' physical and psychological wellbeing, quality of adherence to treatment and on health economics.

The demographic features studied in this study, in a univariate analysis, did not show any significant impact on diabetes control; there was no difference in total diabetes control for those patients above 55 years vs. those below 55 years. This also did not show differences in both gender studied (Table II, III). These results were at odds to the study of Benoit *et al*[17] that showed that younger age was significant in the final models with main effects.

Duration of diabetes exerted an impact on diabetes control; those with shorter duration ≤ 10 years were

having better diabetes control than those with longer duration (34.7% vs. 19.1% p= 0.001; RR=1.83 (1.27-2.62), OR=2.26 (1.38-3.73)). No difference between the two genders studied in this category (Table II). The mean HbA1c was significantly lower in those with shorter duration vs. longer duration. This comes in accordance with UKPDS and other studies[8,14,22,23] and contradicts the results of Nicholas *et al*.[12]

Body mass index was not found to have any impact on diabetes control in this study; all categories of BMI showed no difference in diabetes control rates nor in mean HbA1c levels (Table II, III), these results contradicts the results achieved by Nicholas *et al*[12] and Adham M *et al*[15] who showed a good relationship between BMI and DM control.

This study showed that diabetes control worsen with increasing duration of diabetes being more than 43% achieving DM control of HbA1c ≤ 7 for those < 5 years duration and this drop to ≈20 % for those with duration > 20 years.

This study results is consistent with other international studies that showed that longer duration of diabetes worsens DM control and proved that progressing age impacted the outcome of adequate HbA1c control.[24]

The rather small sample size and calculating the mean of the latest three HbA1c levels are probably limiting factors on final outcome

Summary and Conclusion

The current study showed a modest diabetic control of 28.4% achieving HbA1c <7%. The diabetes duration impacted the outcome when same genders were compared but not when comparing males vs. females.

Age exerted an impact on the mean HbA1c levels being better for females whether below or above 55 years old, while duration impact was evident for mean HbA1c levels being better for males whether below or above 10 years duration . The mean HbA1c showed a steep increase in its level with increasing duration of diabetes. The diabetes control showed a drop in prevalence with increasing diabetes duration

A structured program of intensified diabetes education and follow-up in needed to improve diabetes control in Jordan.

Larger cross sectional studies on factors implicated in diabetes control are warranted to have better predictors of diabetes control and to address theses confounders.

Acknowledgement

The authors wish to thank Mrs Ala' Rifai; Diabetic Dietician, for her help in performing the statistical analysis.

References

1. **Hippisley-Cox J, Pringle M, Crown N, *et al.*** Sex inequalities in ischemic heart disease in general practice: cross-sectional study. *BMJ* 2001; 322:832-834.
2. **Canto JG, Rogers WJ, Goldberg RJ, *et al.*** Association of age and sex with myocardial infarction symptom presentation and in-hospital mortality. *JAMA* 2012; 307(8):813-822.
3. **Nilsson P, Brandstrom H, Lingfors H, *et al.*** Gender differences in secondary prevention: reasons to worry or not? *Scand J Prim Health Care* 2003; 21:37-42.
4. **Siann T, Duncan EM, Sullivan F, *et al.*** Area-wide diabetes care: the Lanarkshire experience with primary health care teams 1994-1997. *Diabetic Med* 1998; 15(Suppl 3):S54-7.
5. **Naar-King S, Idalski A, Ellis D, Frey M, *et al.*** Gender differences in adherence and metabolic control in urban youth with poorly controlled type 1 diabetes: the mediating role of mental health symptoms. *J Pediatr Psychol.* 2006; 31(8):793-802.
6. **Biesenbach G, Bodlaj G, Pieringer H.** Gender-associated Differences in Weight Gain, Insulin Requirement and Metabolic control in newly Insulin-treated Type 2 Diabetic patients with secondary sulfonylurea Failure-a one-year Observation. *Clinical Medicine: Endocrinology and Diabetes* 2009; 2:75-80
7. **Rurik I.** Nutritional differences between elderly men and women. Primary care evaluation in Hungary. *Ann Nutr Metab* 2006; 45-50.
8. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet* 1998; 352(9131):837-53.
9. **Egede LE, Gebregziabher M, Hunt KJ, *et al.*** And racial/ethnic variation in glycemic control in a national sample of veterans with diabetes. *Diabetes Care* 2011; 34: 938-943.
10. **Harris MI, Eastman RC, Cowie CC, *et al.*** Racial and ethnic differences in glycemic control of adults with type 2 diabetes. *Diabetes Care* 1999; 22:403-408.
11. **Shorr RI, Franse LV, Resnick HE, *et al.*** Glycemic control of older adults with type 2 diabetes: Findings from the Third National Health

and Nutrition Examination Survey, 1988–1994. *J Am Geriatr Soc* 2000; 48:264–267.
12. **Nichols GA, Hillier TA, Javor K, *et al.*** Predictors of glycemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 2000; 23:273–277.
13. **Blaum CS, Velez L, Hiss RG, *et al.*** Characteristics related to poor glycemic control in NIDDM patients in community practice. *Diabetes Care* 1997; 20:7–11.
14. **Ajlouni K, Khader YS, Batieha A, *et al.*** An increase in prevalence of diabetes mellitus in Jordan over 10 years. *J Diabetes Complications* 2008; 22(5):317-324.
15. **Adham M, Froelicher ES, Batieha A**, ***et al.*** Glycaemic control and its associated factors in type 2 diabetic patients in Amman, Jordan. *Eastern Mediterranean Health Journal* 2010;16(7):732-739
16. Diagnosis and Classification of Diabetes Mellitus. American Diabetes Association. *Diabetes Care* 2006; 29:S43-S48
17. **WHO expert consultation.** Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet* 2004; 157-163.
18. **Benoit SR, Fleming R, Ming JI.** Predictors of glycemic control among patients with Type 2 diabetes: *A longitudinal study BMC Public Health* 2005; 5: 36.
19. **Akbar DH.** Low rates of diabetic patients reaching good control targets. *East Mediterr Health J* 2001; 7(4-5):671-678.
20. **Al- Sultan F, Al-Zanki N.** Clinical epidemiology of type 2 diabetes mellitus in Kuwait. *Kuwait Medical Journal* 2005;37: 98-104
21. **Guzder RN, Gatling W, Mullee MA**, ***et al.*** Impact of metabolic syndrome criteria on cardiovascular disease risk in people with newly diagnosed type 2 diabetes. *Diabetologia* 2006; 49(1): 49-55.
22. **Saaddine JB, Cadwell B, Gregg EW, *et al.*** Improvements in diabetes processes of care and intermediate outcomes: United States, 1988-2002. *Ann Intern Med* 2006; 144(7): 465-474.
23. **Goudswaard AN, Stolk RP, Zuithoff P, *et al.*** Patient characteristics do not predict poor glycaemic control in type 2 diabetes patients treated in primary care. *Eur J Epidemiol* 2004; 19(6):541-545.
24. **El-Kebbi IM, Cook CB, Ziemer DC, *et al.*** Association of younger age with poor glycemic control and obesity in urban African Americans with type 2 diabetes. *Arch Intern Med* 2003;163(1): 69-75