Gender satisfaction among Type 2 diabetes patients: A comparison between intensive diets, lifestyle intervention with medication controlled management

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ABSTRACT

Background: Exactly when to initiate insulin in recent onset Type 2 Diabetes Mellitus (T2DM) remains unclear. Emerging evidence suggests that increased physical activity and weight loss can delay or prevent the onset of T2DM, and in some cases normalise blood glucose levels.

Aim: The aim of the study is to investigate gender satisfaction of health quality of life at achieving better glycaemic - HbA1c level in patients with T2DM in comparison to intensive dietary and lifestyle interventions with medication controlled management.

Subjects and Methods: A cross-sectional comparison study was designed based on 1,386 available participants with diagnosed T2DM at the Primary Health Care (PHC) and Hamad General Hospital in Qatar during the period from November 2012 to June 2014. 1,386 participants were evaluated to get either conventional therapy (dietary restriction) or intensive therapy (metformin, sulfonylurea, sitagliptin) for glucose control. The changes in serum lipid profiles (cholesterol, LDL, HDL), uric acid, blood pressure and glycated hemoglobin (HbA1c) were analysed at baseline and after twelve months. In addition, socio-demographic data was collected and univariate and multivariate statistical analysis was performed.

Results: There were statistically significant differences between female and male patients in terms of age ($p<0.001$), ethnicity ($p=0.012$), occupation ($p<0.001$), monthly income ($p<0.001$), physical exercise ($p<0.001$), sport activity ($p=0.018$), cigarette smoking ($p<0.001$), shisha smoking ($p=0.036$) and consanguinity ($p=0.012$). Significantly greater improvements in mean values of blood glucose (-2.50 vs. -2.46; $p=0.001$), HbA1c (-1.22 vs. -1.21; $p=0.001$), and cholesterol (-1.51 vs. -0.59; $p=0.001$) were found in female patients. Reductions in blood glucose, HbA1c, total cholesterol, HDL, albumin, urea triglyceride, and blood pressure systolic and diastolic were found in both genders. Male patients had higher changes in systolic blood pressure (-4.4 vs. -3.9; $p<0.001$) urea (1.04 vs. -0.83; $p<0.001$), LDL (-0.13 vs. +0.16; $p<0.001$) and albumin (-3.56 vs. -3.61; $p<0.001$) in comparison to females.

Conclusion: Current study indicates that intensive lifestyle changes, physical exercise and metformin treatment have favourable effects on patients at high risk for T2DM. Lifestyle modifications based on physical, dietary interventions and medication are associated with improvements in the blood glucose and HbA1c levels in patients with T2DM. Even those with gross glycaemic abnormalities, more than 60% can achieve target glycaemic control using diet, lifestyle and metformin.

INTRODUCTION

Type 2 Diabetes Mellitus, one of the most challenging public health concerns of the aging population in the 21st century, is described as a worldwide epidemic as it has effects on the health and economic conditions of numerous countries regardless of socioeconomic status or geographic

location [1].

Type 2 Diabetes Mellitus leads to an increase in the risk of cardiovascular diseases [2-4] and is the principal cause of death in many developing and high income countries [3-5]. Lifestyle factors, sleep duration, physical activity, regular exercise and healthy-balanced diet are essential components in prevention of pre-diabetes [6-8]. Nonadherence to medication is a serious public health concern especially among T2DM patients, as poor adherence to antidiabetic agents leads to uncontrolled glycaemia. At the national level, adherence to diabetes drugs is estimated range between 36% and 81% by using an average proportion of days covered, and between 38% and 47% for diabetes control [9].

With respect to drug therapy management of hyperglycaemia, metformin is the first drug choice in patients with newly diagnosed T2DM or in patients whose lifestyle medications fail to attain adequate glycaemic control according to guidelines and in the absence of contraindications [10-12]. At the time of diagnosis, an opportunity to change their lifestyles during 3–6 months before starting pharmacotherapy (usually metformin) could be given to highly motivated patients who had nearly target HbA1c level (e.g. <7.5%) [13-15]. The American Association of Clinical Endocrinologists and American College of Endocrinology (AACE/ACE) recommended starting insulin in symptomatic patients with HbA1c higher than 9% and the National Institute for Health and Care Excellence (NICE) stated starting insulin in those with HbA1c higher than 7.5% despite other measures [16]. Moreover, an association was found between depressive symptoms, and worsened blood glucose levels and diabetic complications such as coronary heart disease [13, 14, 16]. The functional and behavioural costs (e.g. poorer adherence to diet, exercise and medications) for patients with diabetes and depression were higher compared to those with only diabetes [8,16]. Studies considered the clinical effectiveness of different types of diabetes treatment models [17] by evaluating quality of life among patients and quality of treatment to focus the management of diabetes via diet, clinical outcomes in patients followed by different groups of physicians and treatment satisfaction [16,17].

Type 2 Diabetes mellitus is a growing burden on the health, wealth and productivity of individuals in all developed and developing communities [1, 3, 18-21]. Poverty, socioeconomic stress, psycho-social condition and sedentary lifestyle lead to an increase in obesity and T2DM [7-8,19-21] as well as morbidity and premature mortality of T2DM [4–6]. This study aims to investigate gender satisfaction of health quality of life targeted at achieving better glycaemic - HbA1c treatment in patients with T2DM in comparison to intensive dietary and lifestyle interventions with medication controlled management.

SUBJECTS AND METHODS

This is a cross-sectional comparison study, which was conducted among diabetic patients aged 30 years and above registered in diabetic clinics of Hamad General Hospital and PHC Centres in Qatar during a period from November 2012 to July 2014. Only Qatari nationals or non-Qatari Arab ethnicity patients residing in Qatar were included in the present study. Non-Arab patients with diabetes were excluded. IRB ethical approval was obtained from Hamad Medical Corporation and PHC Centre before commencing data collection. A multistage stratified cluster sampling design was performed. Twenty-two primary health care centres were available, however 13 were selected randomly. Of these, 10 primary health care centres were located in urban areas and rest of them were in semi-urban areas.

The study performed routine follow up of 1,386 patients diagnosed with T2DM who had appropriate blood samples stored at 15-24°C and agreed to participate in this study. The classification of participants was determined by receiving type of interventions for comparison: either the medication therapy or the physical exercise and intensive lifestyle modification program. Aims of physical exercise and intensive lifestyle change in participants were to achieve and maintain at least 7% reduction of initial body weight through a calorie-controlled and low-fat diet, and physical activity at least 150 min per week [13, 20-21]. In present study, patients with T2DM were enrolled regarding to American Diabetes Association [ADA] criteria [2]. 1,386 patients with T2DM were approached and assigned to get either conventional therapy (dietary restriction) or intensive therapy (metformin, sulfonylurea, sitagliptin) for glucose control. They were available for the analysis of the changes with intervention at over 1 year. The number of patients treated with diet, lifestyle, physical exercise was 556, then with metformin n=617 patients (generic 1000 mg twice daily after gradually build-up dose over 2 weeks) and/or sulfonylurea (usually glimepiride 4mg daily), n=139 patients or sitagliptin 100 mg daily which was used for a minority of patients n=74. Most of the patients refused to take insulin regardless of presence of glycaemia or HbA1c levels, because of insulin phobia and psychological resistance to insulin among patients with T2DM.

Laboratory measurements

Diabetes Mellitus was defined according to the ADA [2] with fasting venous blood glucose concentration equal or higher than 7.0 mmol/L and/or 2h post oral glucose tolerance test (OGTT) venous blood glucose concentration higher than 11.1 mmol/L. A glucose meter was used to determine fasting blood glucose of all the subjects. OGTT was performed only if blood glucose was less than 7.0 mmol/L. The inclusion criteria consisted of: (1) diagnosis of T2DM in accordance with

international standards by the ADA [2], fasting plasma glucose (FPG) higher than 7.0 mmol/L and/or 2 hours postprandial plasma glucose (PPG) or random plasma glucose higher than 11.1 mmol/L; (2) for at least 1 year regular anti-diabetic drug treatment; (3) being older than 30 years old; (4) Qatari resident for longer than 2 years; and (5) providing written approval for participation to the study.

Diabetes Quality of Life Measure (DQOL)

The DQOL measure was developed from the widely used DQOL measure which recommended by Bradley [17] and available in a variety of languages [18]. DQOL contains 15 items scored on 6-point scales, where the DQOL measures directly the comparison of participants' experience of the current treatment and their experience of treatment before the study began [18]. DQOL scores range from 1 to 5, such as, 1 = *very satisfied;* 2 = *moderate satisfied;* 3= *neither; 4= moderate dissatisfied* and 5 = *very dissatisfied.*

Questionnaire

The first part of the questionnaire comprised of information about socio-demographic and anthropometric characteristics including age, sex, nationality, education level, height, weight, parental consanguinity, family history of diabetes, type of diabetes, co-morbid hypertension and diabetic complications. Furthermore, information about lifestyle habits like physical activity and smoking habits were gathered. Content validity, face validity, and reliability of the questionnaire were re-tested using 68 subjects, although Bener et al. [18] had validated the present questionnaire previously for Qatar. The necessary corrections and modifications were performed after evaluated the minor differences and discrepancies found during the pilot study. A high level of validity and a high degree of repeatability (kappa = 0.87) were found.

A trained nurse performed measurements and physical examination. Height in centimeters was measured using a height scale (SECA, Germany) while weight in kilograms was measured using a weight scale (SECA, Germany). Then, BMI was calculated as; weight in kilograms divided by the square of height in meters. Obesity and overweight were classified according to WHO criteria [22]. BMI value $\geq$30 kg/m^2 was considered as obese; and between 25-30 kg/m^2 was overweight.

Hypertension was defined regarding to World Health Organization (WHO) [22]. Criteria as Systolic Blood Pressure (SBP) $\geq$ 140 mmHg or Diastolic Blood Pressure (DBP) $\geq$90 mmHg or using anti-hypertensive medication were determined by International Society of Hypertension Writing Group. SBP and DBP blood pressure were measured with a standard zero mercury sphygmomanometer and two times from the subject's left arm while seated with his/her arm at heart level after at least 10-15 minutes of rest, and then mean was calculated. Smoking habits were

classified in terms of currently being smoker or non-smoker. Patients that participated in walking or cycling for more than 30 minutes/day were classified as physically active.

For differences between mean values of two continuous variables Student's t-test was used and confirmed by non-parametric Mann-Whitney test. Paired *t*-test was used to determine the difference between baseline and the year before for biochemistry parameters, and this was confirmed by the Wilcoxon test which is a nonparametric test that compares two paired groups. To test for differences in proportions of categorical variables between two or more groups Chi-square and Fisher exact tests were performed. To evaluate the strength of concordance between variables Pearson's correlation coefficient was used. The level $p<0.05$ was considered as the cut-off value for significance.

RESULTS

Table 1 shows the comparison of socio-demographic characteristics between female and male patients. There was a statistically significant difference between female and male patients in terms of age ($p<0.001$), ethnicity ($p=0.012$), occupation ($p<0.001$), monthly income ($p<0.001$), physical exercise ($p<0.001$), sport activity ($p=0.018$), cigarette smoking ($p<0.001$), shisha smoking ($p=0.036$) and consanguinity ($p=0.012$).

Table 2 represents the clinical characteristics of the subjects with T2DM by gender. Overall, mean (standard deviation) age of our studied sample was 51.7 ±11.1 years with nearly similar distribution in males (51.1 ± 10.04) and in females (52.3 ± 11.7). Self-reported average number of hours of sleep was significantly more among males (6.5 ± 1.17 vs. 6.3 ± 1.27; $p<0.001$) than females. Approximately half of the female patients with diabetes (45.7%) were overweight while more than a quarter of females (32.2%) were obese. Similarly, 47.5% males were overweight while only 25.8% males were obese. There was a significant difference between females and males in terms of being overweight and obese ($p= 0.017$). More than one-third (42.8% males and 43% females) had diabetes for the last 5-9 years while only a quarter of males (29.6%) and females (33.7%) had diabetes for the last 10 or more than 10 years. The difference in duration of diabetes by gender was not significant ($p = 0.128$).

In Table 3, biochemical parameters were compared by gender. It was reported that females had significantly greater improvements in mean values of blood glucose (-2.50 vs. -2.46; $p<0.001$), HbA1c (-1.22 vs. -1.21; $p<0.001$), cholesterol (-1.51 vs. -0.59; $p<0.001$). Reductions in blood glucose, HbA1c, total cholesterol, HDL, albumin, urea triglycerides, and blood pressure systolic and diastolic were found in both genders. There were improved measures in systolic blood pressure (-4.4 vs. -3.9; $p<0.001$) and urea (1.04 vs. -0.83, $p<0.001$) in males in comparison to females.

Table 4 presents DQOL measure of studied subjects by gender. As can be seen from this table relationship between DQOL measure and treatment satisfaction is much higher in most items among females compared to males and the difference was statistically significant.

Figure 1 shows patients that achieved target HbA1c < 7% in mean reduction according to treatment group after 12 months. The mean HbA1c reduction in the diet, lifestyle and metformin treatment was -2.21 ± 2.4. In those achieving target HbA1c <7%, 60.3% of the patients were on diet, lifestyle and metformin. On those with grossly high HbA1c (>10%) and plasma glucose (>300 mg/dl), 62% of patients achieved the target by the diet, lifestyle and metformin.

DISCUSSION

Type 2 Diabetes mellitus is a chronic metabolic disease that causes a wide range of complications such as neuropathy, nephropathy, retinopathy, hearing loss, and cerebrovascular and cardiovascular diseases. As a result of the rapid economic development and the associated lifestyle changes in a negative way in Qatar, an increase was found in the prevalence of coronary heart disease (CHD) that is one of the top three leading causes of death among Qatari population [18, 19]. Lifestyle interventions were a centrepiece of effective diabetes self-management and helped to prevent the onset of T2DM [9, 11, 12, 21]. Lifestyle intervention has not been considered to treat the depression although depression was an essential co-morbid disease of diabetes [16, 18].

Being overweight and obese are key contributors to the global diabetes and affecting not only the developed countries but also developing countries. In Qatar the prevalence of being overweight and obese is relatively very high with over 25% of females compared with the Western countries [6, 7, 19]. Moreover, it shows a gradually increase with economic development and rapid urbanization [7, 18, 24, 25].

It has been reported in numerous studies that increased physical activity reduces the risk of diabetes, while sedentary behaviours increase its risk [5, 7, 8, 11-21, 23-27]. Previous studies by Bener et al. [8, 24, 25] pointed out that only 33.1% of diabetes patients perform daily physical activities. A study by Hu et al. [5] showed an association between sedentary behaviours and significantly increased risk of obesity and Type 2 Diabetes. In the current study, diabetes patients, a number of socio-demographic parameters, lifestyle and physical exercise were positively associated with treatment satisfaction that affects quality of their life and patients' satisfaction.

Metformin is chosen primarily as a drug for glycaemic control in patients with T2DM. The major benefit of metformin is that it usually does not lead to hypoglycaemia when used as monotherapy. It is neutral for weight loss, and it has been shown to decrease plasma triglycerides concentration by 10% to 20% [23].

A considerable amount of studies suggest that the greater part of T2DM can be prevented via diet and lifestyle modification [5, 6, 12, 20-29]. However, not only individual behavioural changes, but also changes in food, culture, and social environments are necessary for healthy diet and lifestyle adaptation [6, 8, 18, 24-29]. Basis changes in public policies and health system are essential to transfer of clinical and epidemiologic findings into practice. Advertisement of health diet and lifestyle should be a global priority issue for diabetes prevention.

Qatar has similar diabetes rate with other industrialized countries and it is a known risk factor for the CHD [6, 16]. The recent study [26] reported that one-third of patients with CHD had Type 2 Diabetes at baseline. Individuals with T2DM are also at increased risk of mortality compared with non-diabetics, with heart disease contributing to about three out of every four deaths among persons with diabetes.

The present study has some limitations. First, the results were cross-sectional and the patients in our study population were from a hospital and primary health diabetes care clinics. Second, the correlation between income, sleeping, smoking, and well-being and treatment satisfaction were not performed. Then, the performance and management of patients with diabetes in primary were not compared with tertiary level. It was aimed in the beginning of the study planning. Also, the effects of diabetes patient education on well-being and treatment satisfaction were not evaluated because of not having a formal patient education program and educated staff for all patients.

CONCLUSION

Current study indicates that intensive diet, physical exercise and metformin treatment have favourable effects on diabetes patients at high risk. Lifestyle modifications based on physical, dietary interventions and medication are associated with improvements in the blood glucose and HbA1c levels in T2DM patients. Even those with gross glycemic abnormalities, more than 60% can achieve target glycaemia control using diet, lifestyle and metformin.

Advances in Knowledge

Guidelines recommend the routine start of insulin in patients with Type 2 Diabetes mellitus and severe hyperglycaemia with or without symptoms. The major obstacles starting insulin in developing countries sometimes for a diabetic is the insulin phobia. This leads to barriers in a doctor-patient relationship. The present study aims to reveal the effect and benefit of oral anti-hyperglycaemic agents on those with severe hyperglycaemia with or without symptoms.

Application to Patient Care

Patients diagnosed with T2DM with severe hyperglycaemia may use oral antihyperglycemic

medications with diet and lifestyle changes instead of insulin.

Contributors

AB designed and supervised the study and was involved in data collection, statistical analysis the writing of the paper. AOAA was involved in data collection, interpretation of data and writing manuscript. FÇ, KUR and MG were involved in interpretation of data and writing manuscript. All authors approved the final version.

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Table 1. Comparison of Socio-demographic and Clinical Characteristics Type 2 Diabetes Mellitus by Gender (N= 1,386)

	Total N=1,386 (%)	Males n= 718 (%)	Females n= 668(%)	P value
Age (in years):				
30-39	200 (14.5)	111 (15.5)	89 (13.4)	
40-49	365 (26.4)	194 (27.1)	171 (25.6)	0.001
50-59	506 (36.7)	285 (39.8)	221 (33.3)	
60 and above	309 (22.4)	126 (17.6)	183 (27.6)	
Nationality:				
Qatari	701 (50.6)	233 (32.5)	468 (70.1)	0.012
Non-Qatari	685 (49.4)	485 (67.5)	200 (29.9)	
Level of education:				
Illiterate	226 (16.3)	114 (15.9)	112 (16.8)	
Primary	249 (18.0)	135 (18.8)	114 (17.1)	
Intermediate	277 (200)	146 (20.3)	131 (19.6)	0.068
Secondary	354 (25.5)	163 (22.7)	191 (28.6)	
University	280 (20.2)	160 (22.3)	120 (18.0)	
Occupation				
Housewife	215 (15.5)	0 (0)	214 (32.0)	
Professional	405 (29.2)	267 (37.3)	139 (20.8)	
Clerk	270 (19.5)	196 (27.3)	74 (11.1)	0.001
Businessman	154 (11.1)	105 (14.6)	49 (7.3)	
Police / Army	132 (9.5)	70 (9.7)	62 (9.3)	
Manual	210 (15.2)	80 (11.1)	130 (15.5)	
Monthly income				
<10,000	541 (39.1)	271 (37.7)	270 (40.4)	
10,000-14,999	498 (35.9)	266 (37.0)	232 (34.7)	0.001
15,000>	347 (25.0)	181 (25.3)	166 (24.9)	
Sport activity:				
Yes	358 (26.0)	198 (27.3)	163 (24.4)	0.018
No	1021 (74.0)	520 (72.7)	505 (75.6)	
Physical exercise:				
Yes	378 (27.3)	207 (28.8)	171 (25.6)	0.001
No	1008 (72.7)	511 (712)	497 (74.4)	
Smoking cigarette:				
Smokers	134 (9.7)	95 (17.6)	142 (12.1)	
Ex-smoker	69 (5)	38 (5.3)	31 (4.6)	0.001
None	1183 (85.3)	585 (82.4)	970 (87.9)	
Shisha smoking status:				
Yes	251 (18.1)	115(16.0)	136 (20.4)	0.036
No	1135 (81.9)	6035(84.0)	532 (79.6)	
Consanguinity:				
Yes	454 (32.8)	257 (35.8)	197 (29.5)	0.012
No	932 (67.2)	461 (64.2)	471 (70.5)	

Table 2. Clinical Characteristics of the Studied Subjects by Gender (N=1,386).

Variables	Total N= 1,386 (%)	Males n=718 (%)	Females n=668 (%)	*P* Value
Age in years (mean ± SD)	51.7±11.1	51.1±10.4	52.3±11.7	0.027
Hours of sleep (mean ± SD)	6.39±1.22	6.50±1.17	6.27±1.27	<0.001
BMI				
Normal (<25 Kg/m^2)	340 (24.5)	192 (26.7)	148 (22.2)	
Overweight (25-30 Kg/m^2)	646 (46.6)	341 (47.5)	305 (45.6)	0.017
Obese (30>Kg/m^2)	400 (28.9)	213 (25.8)	215 (32.2)	
Duration of diabetes (years)				
<5	341 (25.5)	190 (27.6)	151 (23.3)	0.128
5-9	573 (42.9)	295 (42.8)	278 (43.0)	
10+	422 (31.6)	204 (29.6)	218 (33.7)	
Diabetic education				
Yes	817 (58.9)	401 (55.8)	416 (62.3)	0.015
No	589 (41.1)	317 (44.2)	252 (37.7)	
Family history of DM				
Negative	859 (62.0)	477 (66.4)	382 (57.2)	<0.001
Mother	94 (6.8)	63 (8.8)	31(4.6)	
Father	106 (7.6)	41 (5.7)	65 (9.7)	
Both Parents	103 (7.4)	46 (6.4)	57 (8.5)	
Siblings	177 (28.3)	66 (9.2)	111 (16.6)	
Grand Parents	47 (3.4)	25 (3.5)	22 (3.3)	
Diabetes complications				
Retinopathy	188 (13.6)	83 (11.6)	105 (15.7)	0.028
Nephropathy	176 (12.7)	108 (15.0)	68 (10.2)	0.008
Neuropathy	143 (10.3)	86 (12.0)	57 (8.5)	0.042
Macro vascular disease	224 (16.2)	100 (13.9)	124 (18.8)	0.020
Diabetic foot ulcer	195 (14.1)	85 (11.8)	110 (16.5)	0.013
Associated symptoms				
Excessive passing of urine	205 (14.8)	90 (12.5)	115 (17.2)	0.015
Excessive thirst	260 (18.8)	120 (16.7)	140 (21.0)	0.046
Weight loss	260 (18.8)	117 (16.3)	143 (21.4)	0.016
Loss of appetite	475 (34.3)	231 (32.2)	244 (36.5)	0.090
Visual disturbance	343 (24.7)	161 (22.4)	182 (27.2)	0.040
Fatigue	201 (14.5)	85 (11.8)	116 (17.4)	0.004
Night cramps	152 (11.0)	65 (9.1)	87 (13.0)	0.002
Sleep loss	169 (12.2)	73 (10.2)	96 (14.4)	0.017
Eat fast food				
Yes	331 (23.9)	190 (28.5)	141 (21.1)	0.021
No	1055 (76.1)	528 (73.5)	527 (78.9)	
Dietary care				
Yes	280 (20.2)	126 (17.5)	154 (23.1)	0.013
No	1106 (79.8)	592 (82.5)	514 (76.9)	
Eating at restaurant				
Never	250 (18.0)	120 (16.7)	130 (19.5)	
Daily	279 (20.1)	167 (23.3)	142 (16.8)	
Weekly	353 (25.5)	183 (29.5)	170 (25.4)	0.018
Monthly	504 (36.4)	248 (24.5)	256 (38.3)	

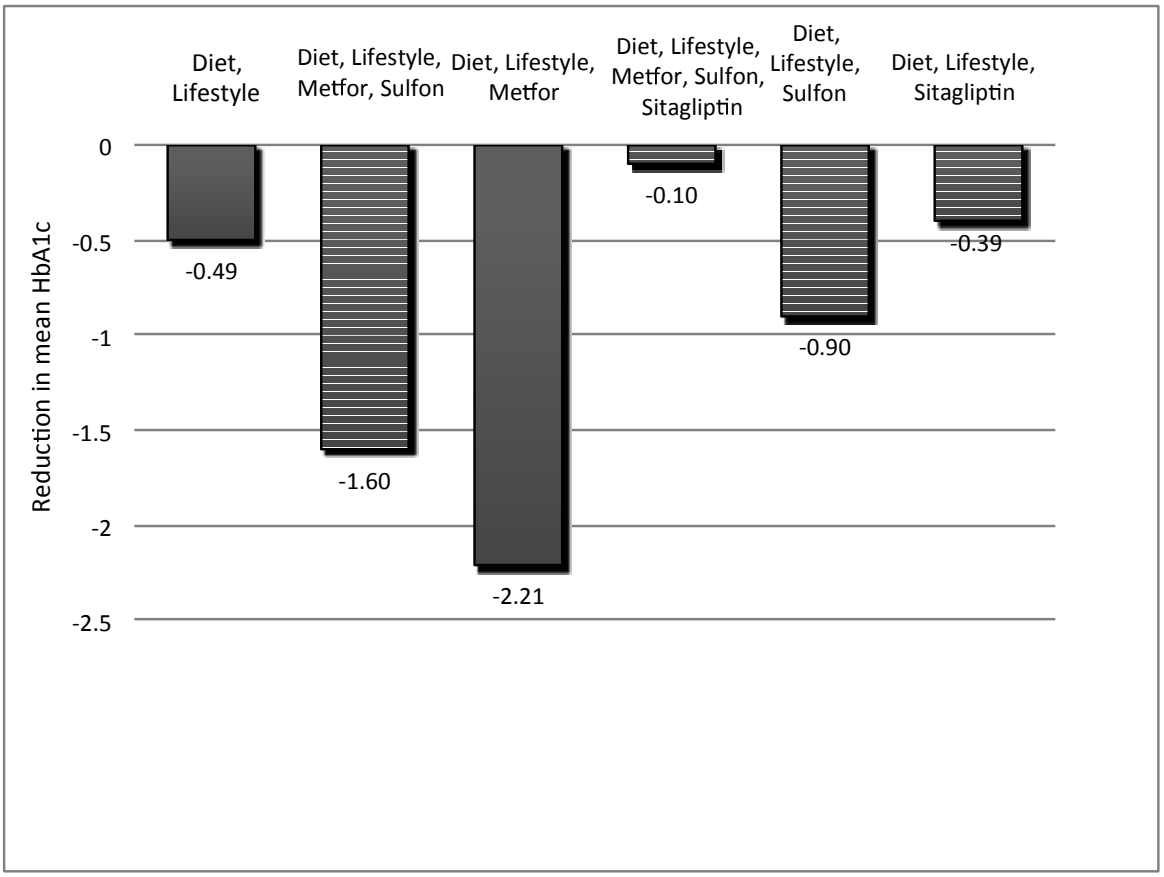
Table 3. Comparison of Baseline Characteristics of T2DM Care by Gender.

Indicator Variable	Males N= 718 (Mean Values)				Females N= 668 (Mean Values)			
	Twelve months before	Baseline	Change (95% CI)	P value	Twelve months before	Baseline	Change (95% CI)	P value
Blood glucose (mmol/L)	9.51	7.04	-2.46 (-2.32 -(-2.61))	<0.001	9.56	7.05	-2.50 (-2.65 -(-2.35))	<0.001
HbA1c	8.74	7.53	-1.21 (-1.21 - (-1.13))	<0.001	8.83	7.60	-1.22 (-1.31 - (-1.13))	<0.001
Cholesterol (mmol/L)	4.90	3.31	-0.59 (-1.68 - (-1.49))	0.004	4.99	3.48	-1.51 (-1.61 – 1.41)	<0.001
HDL(mmol/L)	1.61	1.62	-0.006 (-0.90 –(- 0.088))	0.988	1.22	1.42	-0.20 (-0.58–(+ 0.18))	0.298
LDL(mmol/L)	1.95	2.09	-0.13 (-0.29 - (-0.25))	<0.023	1.86	2.02	+0.16 (0.07 –(-0.24))	<0.001
Urea(mmol/L)	5.14	6.38	+1.04 (0.73 -1.35)	<0.001	5.20	4.37	-0.83 (-0.96 -(- 0.70))	<0.001
Creatinine (mmol/L)	83.05	86.13	+3.07 (+0.96 – 5.17)	0.004	71.87	73.33	+1.45 (1.05 - 3.96)	0.255
Potassium (mmol/L)	3.59	4.88	+1.29 (0.60 -1.98)	<0.001	3.43	4.73	+1.33 (0.87 – 1.72)	<0.001
Albumin (mmol/L)	42.19	38.63	-3.56 (-3.93 – (-0.47))	<0.001	41.43	37.81	-3.61 (-4.08 –(-3.14))	<0.001
Bilirubin (mmol/L)	10.17	12.25	+2.08 (2.61 – 6.77)	0.384	8.51	8.10	-0.40 (-1.02 -(- 0.31))	0.197
Triglyceride (mmol/L)	2.25	2.08	-0.17 (-0.70 – (-0.37))	0.548	2.05	1.91	-0.13 (-0.65 –(-0.38))	0.879
Calcium (mmol/L)	2.13	3.03	+0.89 (0.30 – 1.49)	0.003	2.04	2.45	+0.41 (0.19 - 0.62)	<0.001
Uric acid (mmol/L)	277.1	293.7	+16.62 (10.17 – 23.07)	<0.001	276.8	287.6	+10.7 (4.38 – 17.1)	<0.001
Blood pressure SBP(mmHg)	132.1	128.2	-4.4 (-11.40 - (-6.69))	<0.001	133.2	129.3	-3.9 (-8.58 -(-4.65))	<0.001
DBP(mmHg)	82.7	79.7	-3.0 (-3.66 - 0.41)	<0.001	83.8	80.7	-3.1 (-3.33 - 0.93)	<0.001

Table 4. Diabetes Treatment Satisfaction and Quality of Life Measurement Studied Subjects by Gender (N=1,386).

	Very satisfied		Moderately satisfied		Neither		Moderately dissatisfied		Very dissatisfied		p Values
1.Satisfied with manage your DM											
Male (n,%)	80	38.8	116	49.8	203	63.8	171	52.9	148	48.4	p<0.001
Female (n,%)	126	61.2	117	50.2	115	36.2	152	47.1	158	51.6	
2.Satisfied with your checkups											
Male (n,%)	121	50.0	139	52.5	195	62.1	149	47.2	114	45.8	p<0.001
Female (n,%)	121	50.0	126	47.5	119	37.9	167	52.8	135	54.2	
3.Satisfied with your glucose level											
Male (n,%)	97	44.9	126	47.2	204	56.0	123	47.3	168	60.2	p<0.001
Female (n.%)	119	55.1	141	52.8	160	44.0	137	52.7	111	39.8	
4.How satisfied with dieting											
Male (n,%)	136	54.4	176	53.5	157	55.5	161	46.7	88	49.2	p<0.001
Female (n,%)	114	45.6	153	46.5	126	44.5	184	53.3	91	50.8	
5.Current treatment											
Male (n,%)	98	52.4	110	51.9	231	47.5	105	50.2	174	59.6	p=0.028
Female (n,%)	89	47.6	102	48.1	255	52.5	104	49.8	118	40.4	
6.Burden diabetes											
Male (n,%)	116	53.7	128	48.3	132	49.8	204	55.9	138	50.2	p=0.312
Female (n,%)	100	46.3	137	51.7	133	50.2	161	44.1	137	49.8	
7.Knowledge of diabetes											
Male (n,%)	128	55.4	127	43.3	145	52.3	169	58.3	149	50.5	p=0.005
Female (n,%)	103	44.6	166	56.7	132	47.7	121	41.7	146	49.5	
8.Sleep satisfaction											
Male (n,%)	117	52.5	146	50.3	146	50.3	143	53.2	166	52.9	p=0.928
Female (n,%)	106	47.5	144	49.7	144	49.7	126	46.8	148	47.1	
9.How satisfied social relationship											
Male (n,%)	91	39.6	117	49.2	217	66.0	139	51.1	154	48.6	p<0.001
Female (n,%)	139	60.4	121	50.8	112	34.0	133	48.9	163	51.4	
10.Sex Life											
Male (n,%)	110	50.7	128	50.6	196	59.0	154	48.4	130	48.9	p=0.048
Female (n,%)	107	49.3	125	49.4	136	41.0	164	51.6	136	51.1	
11.Work an house activities											
Male (n,%)	115	44.9	128	47.2	205	56.5	117	49.4	153	59.1	p=0.003
Female (n,%)	141	55.1	143	52.8	158	43.5	120	50.6	106	40.9	
12.Howsatisfied with body image											
Male (n,%)	92	51.7	98	50.8	151	45.2	132	52.4	245	57.1	p=0.029
Female (n,%)	86	48.3	95	49.2	183	54.8	120	47.6	184	42.9	
13.Physical exercise											
Male (n,%)	103	46.8	111	56.3	139	53.1	158	47.4	207	55.3	p=0.078
Female (n,%)	117	53.2	86	43.7	123	46.9	175	52.6	167	44.7	
14.Leisure timing											
Male (n,%)	77	46.4	126	49.2	156	49.5	173	57.5	186	53.4	p=0.110
Female (n,%)	89	53.6	130	50.8	159	50.5	128	42.5	162	46.6	
15.Satisfied in general with life											
Male (n,%)	79	48.8	110	37.9	166	53.5	202	61.6	161	54.4	p<0.001
Female (n,%)	83	51.2	180	62.1	144	46.5	126	38.4	135	45.6	

Figure 1. Patients achieved target HbA1c < 7% in mean reduction according to treatment group after 12 months *.



* p<0.001 Significance differences between before and after for all mode of treatment