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Research Article

Can metabolic control variables of diabetic patients predict their quality of life?

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Abstract

The type and the complexity of regimen aimed at achieving better glycemic control may impact patient's health-related quality of life (HRQoL) in diabetic patients. But, the relationship between HbA1c levels of diabetic patients and their HRQoL is not clear. Our study aims to determine whether metabolic control variables can predict HRQoL or not and also the impact of hypertension (HT) on HRQoL in type II diabetic patients. A total of 469 patients with type II diabetes and 134 control subjects were studied. Medical Outcomes Study Short-Form-General Health Survey (SF-36) questionnaire was used as a health survey tool to measure the QoL of patients in the study. SF-36 includes 8 individual subscales and two summary scales (physical component summary [PCS] and mental component summary [MCS]). Age, gender, fasting blood glucose, postprandial blood glucose, HbA1c, high-density lipoprotein–cholesterol (HDL-C), low-density lipoprotein–cholesterol (LDL-C), triglyceride, total cholesterol, Apolipoprotein B (apoB), non–HDL-C, and body mass index values of the subjects were recorded. For statistical evaluation, SPSS (Statistical Package for the Social Sciences) 15 under Windows 7 was used. MCS values of patients group were statistically lower than control group ($P < .05$). There was no significant difference in PCS values between groups ($P > .05$). Diabetic patients with HT had significantly lower PCS and MCS values than those without HT. In addition, there was a negative correlation between HbA1c level and PCS and MCS values ($P < .05$). Hypertensive diabetic patients had significantly higher fasting blood glucose, postprandial blood glucose, HbA1c, HDL-C, LDL-C, total cholesterol, and body mass index values than hypertensive control subjects ($P < .05$). Normotensive diabetic patients also had significantly lower PCS value than normotensive control subjects ($P < .05$). But, MCS value was not different between groups ($P > .05$). PCS values in diabetic male patients were significantly higher than in diabetic female patients ($P < .05$). MCS value did not differ by gender in diabetic patients ($P > .05$). In our study, it is clear that diabetes affected the patients' HRQoL. In addition, we showed negative correlations between HbA1c levels and PCS and MCS values. There was a significant difference in PCS scores between genders in patients with diabetes. But, there was no significant difference in PCS and MCS values by age in diabetic patients. And having concomitant HT in diabetic patients causes a decrease in both MCS and PCS scores. Thus, HT is an important factor that should be considered in QoL of the diabetic patients. J Am Soc Hypertens 2016;10(1):81–88.

Keywords: Metabolic control variables; quality of life; SF-36; type 2 diabetes mellitus.

Introduction

Diabetes mellitus (DM) is one of the most common metabolic disorders in the world, and the prevalence of diabetes has been increasing. By year 2035, it is estimated that more than 500 million people across the world will live with DM.[1] Because of the increasing prevalence of DM, pure drug therapy will not be sufficient by the reason of the fact that large proportions of patients still continue to

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have poor glycemic (46.5%), blood pressure (48.2%), and cholesterol control (47%).[2]

DM requires continuous medical care and needs multifactorial risk reduction strategies beyond glycemic control. But, most of newly developed treatment strategies in DM are mainly focused on laboratory outcomes. World Health Organization defined health as a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity.[3] Thus, quality of life (QoL) must be considered as an important health outcome and an ultimate goal of all health interventions.

Achieving HbA1c, a universally regarded index of glycemic control, lower than 7% is one of the major objectives in the current clinical management of diabetes.[4] However, the type and the complexity of regimen aimed at achieving better glycemic control may impact patient's health-related quality of life (HRQoL). In addition, diabetic complications lead to compromised HRQoL. The incidence (presence and number) of diabetic complications has been shown to have a significant impact on QoL in a number of studies.[5–7] Thus, there has been an increasing interest in the association between the QoL of patients with DM and their glycemic control.

Previous studies have produced inconsistent findings regarding the relationship between glycemic control and QoL. Thus, the relationship between HbA1c levels of diabetic patients and their QoL is not clear. Some studies found limited relation between glycemic control and HRQoL by using a number of measures,[8–12] whereas others did not.[10,13] Although the association is inconclusive, poor glycemic control in diabetic patients may result an increase in the risk of developing complications that will lead to poor QoL.[14]

QoL can be measured with instruments such as questionnaires. One of the most widely used generic measures of QoL in studies of diabetic patients is the Medical Outcomes Study Short-Form-General Health Survey (SF-36). SF-36 helps to determine the QoL of diabetic patients and about their functional health statuses, and is also a valid, suitable, and reliable test, which helps observation of relationships between other chronic disease coexistence and patient's experience.[15,16] SF-36 yields an 8-scale profile of functional health and well-being scores (so called domain scores) as well as psychometrically based physical and mental health summary measures (physical component summary [PCS] and mental component summary [MCS]) and a preference-based health utility index.[17]

Our study aims to determine whether metabolic control variables can predict QoL or not and also the impact of hypertension (HT) on QoL in type 2 diabetic patients.

Material and Methods

A total of 469 patients with type 2 diabetes and 134 control subjects were included in our study. Patients, who had acute and chronic infections, thyroid impairment, malignancy, renal failure, and history of rheumatological disease, were not included in the study. Additional exclusion criteria were as follows: those with a history of cognitive impairment or substance abuse and complications unrelated to DM based on a personal declaration or information from their medical records. Approval of the local ethics committee was obtained for this study. The study subjects were informed both verbally and in writing about the contents of the study, and they were included in the study after their consents were taken.

Medical Outcomes Study Short-Form-General Health Survey (SF-36) questionnaire was used as a health survey tool to measure the QoL of patients in the study.[17] SF-36 includes 8 individual subscales (physical function, physical role, emotional role, social function, bodily pain, mental health, vitality, and general health perceptions), one extra item (change in health status since last year), and two summary scales (PCS and MCS). A higher SF-36 score indicates better functioning. Patients completed the SF-36 using the pencil and paper method in a separate and quiet room while their relatives and/or friends are waiting outside the room to avoid bias. During the administration of the questionnaire, a researcher was readily available to assist the patients in understanding the SF-36 if required. The researchers were instructed to minimize the explanation, and the patients were asked to answer the question according to their understanding. After completion of the questionnaire, the researcher determined the completeness of the returned SF-36.

Age, gender, fasting blood glucose (FBG), postprandial blood glucose (PBG), HbA1c, high-density lipoprotein–cholesterol (HDL-C), low-density lipoprotein–cholesterol (LDL-C), triglyceride, total cholesterol, Apolipoprotein B (apoB), non–HDL-C, and body mass index (BMI) values of the subjects were recorded. FBG, PBG, HDL-C, LDL-C, triglyceride, and total cholesterol values were measured using a Roche Cobas 8000 device and Roche commercial kits (Roche Diagnostics, Mannheim, Germany) with the enzymatic colorimetric method. ApoB was measured by an immunonephelometric assay. HbA1c levels were measured with a Premier Hb9210 (Trinity Biotech, USA) device using its original kits with the HPLC Borronate Affinity method. BMI was calculated as weight in kilograms divided by square of height in meters. All HbA1c values were given as relative concentration in percentage (Diabetes Control and Complications Trial, DCCT, aligned results). The participants were asked to fast and arrive before breakfast to undergo blood sampling and a thorough clinical examination.

For statistical evaluation, SPSS (Statistical Package for the Social Sciences) 15 under Windows 7 was used. During the evaluation of study variables, categorical, and continuous variables were summarized using the descriptive statistics (eg, median, range, frequency, and percentage) and compared with Kruskal-Wallis H and Mann-Whitney U

tests. A value of $P < .05$ was considered as statistically significant.

Results

A total of 469 patients with type 2 diabetes and 134 control subjects were studied. Female and male percentages of patients group and control group were 54.4%, 45.6% and 53.7%, 46.3%, respectively ($P > .05$). Both study groups were subgrouped according to their serum HbA1c levels ($\leq$6.5; 6.5–8; 8–10; $\geq$10) and presence or absence of HT. Age, gender, HbA1c, and presence or absence of HT distributions of both study groups are shown in Table 1. There were statistically significant differences in the distribution of age, HbA1c, HT between groups ($P < .05$). In addition, mean ages of patients group and control group were 58.46 ± 10.7 and 62.68 ± 12.2 years, respectively ($P < .05$; Table 2).

Mean values of laboratory findings, BMI, PCS, and MCS of both study groups are shown in Table 2. FBG, PBG, HbA1c, HDL-C, LDL-C, total cholesterol, apoB, non–HDL-C, and BMI values of patients group were statistically higher than control group; and ages and MCS values of patients group were statistically lower than control group ($P < .05$). However, there were no significant differences in triglyceride and PCS values between groups ($P > .05$).

When patients group was divided to subgroups according to the presence or absence HT, statistically significant differences were found between subgroups with regard to LDL-C, triglyceride, total cholesterol, PCS, and MCS values ($P < .05$). Diabetic patients with HT had significantly higher LDL-C, triglycerides, and total cholesterol, apoB, and non–HDL-C levels and also significantly lower PCS and MCS values than those without HT. Comparisons of laboratory findings, BMI, PCS, and MCS values between diabetic patients with and without HT are shown in Table 3.

When patients were grouped according to their HbA1c levels ($\leq$6.5; 6.5–8; 8–10; $\geq$10), significant differences were found in all variables, except HDL-C, among subgroups ($P < .05$; Table 4). In addition, there was a positive correlation between the HbA1c values and FBG, PBG, LDL, total cholesterol, apoB, non–HDL-C, and BMI. More importantly, a negative correlation was found between HbA1c level and PCS and MCS values ($P < .05$).

Hypertensive diabetic patients had significantly higher FBG, PBG, HbA1c, HDL-C, LDL-C, total cholesterol, apoB, non–HDL-C, and BMI values than hypertensive control subjects ($P < .05$). Hypertensive diabetic patients also had significantly lower PCS and MCS values than hypertensive control subjects ($P < .05$; Table 5).

In addition, significant differences were found in all variables, except BMI, between normotensive diabetic patients and normotensive control subjects ($P < .05$). Normotensive diabetic patients also had significantly lower PCS value than normotensive control subjects ($P < .05$; Table 5). But, MCS value was not different between groups ($P > .05$).

PCS values in diabetic male patients were significantly higher than in diabetic female patients ($P < .05$). MCS value did not differ by gender in diabetic patients ($P > .05$). But, MCS values were significantly lower in diabetic female patients than control female subjects ($P < .05$).

PCS and MCS values were not significantly different between diabetic patients with $\geq$65 and <65 years of age ($P > .05$). But, MCS values in elderly ($\geq$65 years) diabetic patients were significantly lower in elderly control subjects ($P < .05$). In addition, PCS values in nonelderly diabetic patients were significantly lower than in nonelderly control subjects ($P < .05$).

Table 1
Distribution of sex, age, HT, and HbA1c levels in all participants

Variable	Patient Group		Control Group		Total		*P*
	n	%	n	%	n	%	
Gender							
Male	214	45.6	62	46.3	276	45.8	.896
Female	255	54.4	72	53.7	327	54.2	
HbA1c (%)							
≤6.5	182	38.8	134	100.0	316	52.4	<.05
6.5–8	157	33.5	—	—	157	26.0	
8–10	88	18.8	—	—	88	14.6	
≥10	42	9.0	—	—	42	7.0	
HT							
HT (+)	281	59.9	118	88.1	399	66.2	<.05
HT (−)	188	40.1	16	11.9	204	33.8	
Age (year)							
≥65	150	32.0	70	52.2	220	36.5	<.05
<65	319	68.0	64	47.8	383	63.5	
Total	469	77.8	134	22.2	603		

HT, hypertension.

Table 2
Distribution of age, laboratory values, body mass index, PCS, and MCS levels in all participants

Variable	Patient Group; (Regardless of Having HT)			Control Group; (Regardless of Having HT)			Total			*P*
	Mean ± SD	Min	Max	Mean ± SD	Min	Max	Mean ± SD	Min	Max	
Age (year)	58.46 ± 10.7	27	88	62.68 ± 12.2	42	88	59.39 ± 11.18	27	88	<.05
FBG (mg/dL)	155.84 ± 68.12	43	545	97.46 ± 10.01	80	115	142.87 ± 64.96	43	545	<.05
PBG (mg/dL)	225.34 ± 99.83	3.2	792	121.96 ± 21.97	68	149	202.36 ± 98.51	3.2	792	<.05
HbA1c (%)	7.47 ± 1.78	5.1	15	5.65 ± 0.21	5.1	5.8	7.06 ± 1.75	5.1	15	<.05
HDL-C (mg/dL)	49.09 ± 12.65	21	103	45.46 ± 11.52	24	69	48.29 ± 12.49	21	103	.004
LDL-C (mg/dL)	133.21 ± 37.42	37	266	119.78 ± 24.01	64	161	130.23 ± 35.32	37	266	<.05
Triglyceride (mg/dL)	177.59 ± 100.23	11	776	171.91 ± 85.38	55	428	176.33 ± 97.09	11	776	.902
Total cholesterol (mg/dL)	205.27 ± 44.1	20.9	359	186.73 ± 24.5	121	231	201.15 ± 41.28	20.9	359	<.05
Apolipoprotein B (mg/dL)	104.7 ± 25.6	89	122	91.3 ± 20.4	111	80	97.2 ± 23.4	89	122	<.05
Non–HDL-C (mg/dL)	177.8 ± 32.6	154	191	151.6 ± 32.9	174	118	162.7 ± 24.2	154	191	<.05
BMI (kg/m^2)	29.12 ± 4.28	19	52	27.85 ± 4.76	23.1	39.5	28.84 ± 4.42	19	52	<.05
PCS	34.98 ± 11.7	3.5	65	34.32 ± 10.08	14.5	50.9	34.83 ± 11.35	3.5	65	.528
MCS	38.78 ± 11.24	10.9	63.1	63.64 ± 87.08	26	406	44.31 ± 43.37	10.9	406	<.05

BMI, body mass index; FBG, fasting blood glucose; HDL-C, high-density lipoprotein–cholesterol; HT, hypertension; LDL-C, low-density lipoprotein–cholesterol; MCS, mental component summary; PBG, postprandial blood glucose; PCS, physical component summary; SD, standard deviation.

Discussion

The assessment of outcomes of health care has changed significantly in the past few decades, and the dimension of QoL became an important part of this assessment. People are living longer, and chronic diseases are part of the health experience of the population. Therefore, the inclusion of measures that lead to an improvement in life rather than only prolong it is an essential component of the assessment of health care.

Table 3
Average distribution of laboratory values, BMI, PCS, and MCS levels according to HT in diabetic patients groups

Variable	Hypertension (+); Mean ± SD	Hypertension (−); Mean ± SD	*P*
FBG (mg/dL)	157.44 ± 72.74	153.46 ± 60.68	.730
PBG (mg/dL)	226.01 ± 102.32	224.32 ± 96.25	.854
HbA1c (%)	7.39 ± 1.79	7.58 ± 1.78	.146
HDL-C (mg/dL)	48.89 ± 12.88	49.4 ± 12.32	.520
LDL-C (mg/dL)	134.27 ± 36.86	123.75 ± 13.84	.049
Triglyceride (mg/dL)	178.67 ± 58.05	164.06 ± 108.88	.002
Total cholesterol (mg/dL)	211.78 ± 44.31	197.51 ± 42.68	.001
Apolipoprotein B (mg/dL)	123.7 ± 20.2	94.1 ± 18.2	<.05
Non–HDL-C (mg/dL)	177.8 ± 32.6	141.6 ± 22.9	<.05
BMI (kg/m^2)	29.36 ± 4.33	28.77 ± 4.19	.211
PCS	33.36 ± 9.77	41.45 ± 9.76	.008
MCS	38.17 ± 11.25	41.85 ± 7.28	.011

BMI, body mass index; FBG, fasting blood glucose; HDL-C, high-density lipoprotein–cholesterol; HT, hypertension; LDL-C, low-density lipoprotein–cholesterol; MCS, mental component summary; PBG, postprandial blood glucose; PCS, physical component summary; SD, standard deviation.

It is well-documented that diabetes is not only associated with increased morbidity and mortality but also with poor perception of QoL.[18,19] Studies also showed that people with diabetes-related complications have a reduced QoL compared with those without complications.[13,20] In addition, patients with newly diagnosed diabetes and those with impaired glucose tolerance also have reduced QoL.[21] But, patients with previously diagnosed diabetes are more severely affected on each domain of the 36-Item Short-Form (SF-36) scale than those newly diagnosed diabetes and with impaired glucose tolerance.[21] Despite of new therapeutic advances in diabetes, significant proportion of patients still continue to have poor glycemic (46.5%) and blood pressure (48.2%) control.[22] Side effects and impairment in QoL caused by drug therapy are the major reasons that patients do not adhere to treatment or discontinue it. Because HRQoL is associated with treatment compliance not only in diabetic patients[23] but also in hypertensive patients,[24] monitoring QoL could be one of the best ways to improve compliance. Therefore, disease management programs and public health policy initiatives may also need to focus on understanding the importance of QoL and improving its outcomes in such diseases. Because of all these reasons, US Department of Health and Human Services created a new topic area for Health Goals 2020 (approved for inclusion in July 2013) in regard to define key national objectives of HRQoL and well-being.[2]

Table 4
Average distribution of laboratory values, BMI, PCS, and MCS levels according to HbA1c in patients groups

Variable	HbA1c				*P*
	≤%6.5	%6.5–8	%8–10	≥%10	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
FBG (mg/dL)	113.82 ± 29.19	146.83 ± 40.11	190.52 ± 53.4	298.95 ± 72.94	<.05
PBG (mg/dL)	158.01 ± 52.29	224.34 ± 71.15	286.87 ± 86.01	391.88 ± 100.3	<.05
HDL-C (mg/dL)	50.51 ± 12.44	48.41 ± 13.24	47.22 ± 11.83	49.43 ± 12.65	.076
LDL-C (mg/dL)	131.59 ± 38.06	128.9 ± 33.57	132.65 ± 36.74	157.57 ± 41.81	.001
Triglyceride (mg/dL)	155.57 ± 78.56	191.57 ± 111.6	184.3 ± 109.75	206.76 ± 102.99	.001
Total cholesterol (mg/dL)	201.81 ± 46.23	202.44 ± 39.88	205.45 ± 43.66	230.43 ± 44.07	.002
Apolipoprotein B (mg/dL)	94.1 ± 18.2	123.7 ± 20.2	141.6 ± 22.9	177.8 ± 32.6	<.05
Non–HDL-C (mg/dL)	118 ± 17.3	137 ± 22.4	150.4 ± 21.2	169.3 ± 24.6	<.05
BMI (kg/m^2)	28.16 ± 4.28	29.09 ± 3.92	30.78 ± 4.33	29.97 ± 4.37	<.05
PCS	40.05 ± 10.69	36.94 ± 9.16	26.94 ± 9.75	22.52 ± 10.5	<.05
MCS	44.43 ± 8.41	40.11 ± 8.37	31.61 ± 11.65	24.35 ± 10.15	<.05

BMI, body mass index; FBG, fasting blood glucose; HDL-C, high-density lipoprotein–cholesterol; LDL-C, low-density lipoprotein–cholesterol; MCS, mental component summary; PBG, postprandial blood glucose; PCS, physical component summary; SD, standard deviation.

A specific association between glycemic control (based on HbA1c levels) and the QoL is not clearly evidenced. In our study, we showed negative correlations between HbA1c levels and PCS and MCS values. Previous studies have produced inconsistent findings regarding the relationship between glycemic control and QoL. Some studies indicated that better glycemic control is associated with better QoL,[8,25–27] while others reported weak or no association

Table 5
Average distribution of laboratory values, BMI, PCS, and MCS levels according to HT in control and patients groups

Variable	Patient Group; Mean ± SD	Control Group; Mean ± SD	*P*
Hypertension (+)			
FBG (mg/dL)	157.44 ± 72.74	96.7 ± 10.42	<.05
PBG (mg/dL)	226.01 ± 102.32	119.31 ± 21.94	<.05
HbA1c (%)	7.39 ± 1.79	5.64 ± 0.22	<.05
HDL-C (mg/dL)	48.89 ± 12.88	43.9 ± 10.91	<.05
LDL-C (mg/dL)	134.27 ± 36.86	120.5 ± 25.4	.004
Triglyceride (mg/dL)	178.67 ± 58.05	181.25 ± 86.7	.441
Total cholesterol (mg/dL)	211.78 ± 44.31	187.03 ± 24.86	<.05
BMI (kg/m^2)	29.36 ± 4.33	27.91 ± 5.05	<.05
Apolipoprotein B (mg/dL)	170.4 ± 23.3	139.6 ± 18.8	<.05
Non–HDL-C (mg/dL)	166.7 ± 14.6	145 ± 19.2	<.05
PCS	32.75 ± 10.87	40.03 ± 9.41	<.05
MCS	38.17 ± 11.25	66.75 ± 9.34	<.05
Hypertension (−)			
FBG (mg/dL)	153.46 ± 60.68	103 ± 2.07	<.05
PBG (mg/dL)	224.32 ± 96.25	141.5 ± 7.75	<.05
HbA1c (%)	7.58 ± 1.78	5.75 ± 0.05	<.05
HDL-C (mg/dL)	49.4 ± 12.32	57 ± 9.3	.009
LDL-C (mg/dL)	123.75 ± 13.84	114.5 ± 6.71	.023
Triglyceride (mg/dL)	164.06 ± 108.88	103 ± 15.49	<.05
Total cholesterol (mg/dL)	197.51 ± 42.68	184.5 ± 22.21	.022
Apolipoprotein B (mg/dL)	152.4 ± 13.1	129.6 ± 15.3	<.05
Non–HDL-C (mg/dL)	156.7 ± 17.6	141 ± 18.2	<.05
BMI (kg/m^2)	28.77 ± 4.19	27.4 ± 1.34	.359
PCS	32.26 ± 4.82	41.45 ± 9.76	.041
MCS	38.85 ± 7.28	40.7 ± 9.5	.397

BMI, body mass index; FBG, fasting blood glucose; HDL-C, high-density lipoprotein–cholesterol; HT, hypertension; LDL-C, low-density lipoprotein–cholesterol; MCS, mental component summary; PBG, postprandial blood glucose; PCS, physical component summary; SD, standard deviation.

with QoL.[10,13,27–29] HRQoL is influenced by a several of other factors, such as the existence of other health problems, age, gender, marital status, social relationships, marital status, living status (with family or alone), patient knowledge, education, treatment satisfaction, family history of diabetes, and perceived ability to control one's disease.[14,30,31] In addition, Bradley[32] indicated that confusing health status assessment tools with instruments measuring the QoL of individuals may result in a wrong conclusion. Consequently, variety of the results associated with the relationship between HbA1c and QoL may depend on type of used assessment tool. A recent study by Kamarul et al showed significantly lower QoL scores in diabetic patients with poor glycemic control.[25] But in that study, patients were categorized only as good (HbA1c level $\leq$ 7.5%) and poor (HbA1c level $>$ 7.5%) glycemic controls. Thus, there was no sufficient data to conclude whether HbA1c level is negatively correlated with QoL score. Also a study by Sundaram et al, in which both Medical Outcomes Study Short-Form 12 (SF-12) and Audit of Diabetes-Dependent Quality of Life have been used to assess the patients' QoL in the study, have shown that HbA1c has a low correlation with Audit of Diabetes-Dependent Quality of Life but not with SF-12.[27]

It is clear that diabetes affected the patients' HRQoL (regardless of gender) included in this study. We showed a significant difference in PCS scores between genders in patients with diabetes. It is unclear why PCS appears to be lower for female than male. But, the finding of nonsignificance difference in MCS values among genders supported by another work examining depression and diabetes which found no differences in levels of depression between men and women living with the condition.[33] We did not find any significant difference in PCS and MCS values by age in diabetic patients. But Kalda et al stated in their study that the physical and mental components of the life quality of type 2 diabetic elderly patients are significantly lower than those of the younger diabetic patients.[34]

Efforts to achieve excellent glucose control in the management of diabetes may damage QoL. Huang et al showed that comprehensive diabetes treatments also have significant negative QoL effects when compared to conventional treatments.[35] Patients rated comprehensive treatment states, a combination of cholesterol-lowering medication, aspirin, intensive blood pressure control (three to four blood pressure agents), intensive glucose control (multiple oral agents and insulin that lead to more frequent major hypoglycemic episodes), diet, and exercise, similarly to intermediate complication states of diabetes. QoL related to treatments will be likely to improve if we can simplify or modify current treatments through treatment innovations. In addition, Vijan et al stated in their study that intensive glycemic control for millions of patients should be reconsidered; instead, treating HbA1c less than 9% should be individualized based on estimates of benefit weighed against the patient's views of the burdens of treatment.[36]Therefore, new treatment modalities also should focus on QoL of the patients. For example, sitagliptin, a dipeptidyl peptidase-4 inhibitor, showed improvement not only in glycemic control but also in blood pressure, lipid profiles, and QoL.[37] Another study by Florez et al showed no clear overall benefits on HRQoL in diabetic patients receiving metformin intervention.[38] They have shown that lifestyle modification characterized by intentional weight loss and increased physical activity has an independent but small-to-modest association with better HRQoL in overweight or obese participants at high risk for type 2 DM. In our study, diabetic patients with HT had significantly lower PCS and MCS score than those without HT (Table 3). Also, there was no difference in MCS score between normotensive diabetic patients and normotensive control subjects, whereas a significant difference was detected between hypertensive diabetic patients and hypertensive control patients (Table 5). To sum up, having concomitant HT in diabetic patients causes a decrease in both MCS and PCS scores. This result could be caused not only by symptoms and complications related to HT but also by taking more pills because of HT in these patients. Thus, HT is an important factor that should be considered in QoL of the diabetic patients.

In addition, we should mention about the findings in non–HDL-C and apoB levels of study population. Non–HDL-C and apoB is better predictors for cardiovascular disease in diabetic patients than LDL-C.[39,40] In our study, diabetic patients had significantly higher apoB and non–HDL-C levels than control subjects. In addition, diabetic patients with HT had significantly higher apoB and non–HDL-C levels than those without HT. We showed a positive correlation between HbA1c and apoB which is consistent with a previous study, but further detailed studies are still needed to clarify this point.[41,42]

Conclusion

In our study, it is clear that diabetes affected the patients' HRQoL. A positive correlation between HbA1c and apoB was determined. In addition, we showed negative correlations between HbA1c levels and PCS and MCS values. There was a significant difference in PCS scores between genders in patients with diabetes. But, there was no significant difference in PCS and MCS values by age in diabetic patients. More importantly, having concomitant HT in diabetic patients causes a decrease in both MCS and PCS scores. Thus, HT is an important factor that should be considered in QoL of the diabetic patients.

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