Assessment of quality of life in patients with type 2 diabetes mellitus in Oman

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ABSTRACT

الأهداف: تقييم نوعية الحياة لدى المرضى العمانيين المصابين بداء السكري من النمط الثاني، بالإضافة إلى تحديد العوامل الديموغرافية الاجتماعية والخواص السريرية المرتبطة بالمرض والتي لها تأثير على تحسين نوعية الحياة لدى هؤلاء المرضى.

الطريقة: أجريت هذه الدراسة المقطعية بمستشفى جامعة السلطان قابوس، مسقط، سلطنة عمان عقب الحصول على موافقة لجنة الأخلاقيات الطبية بالمستشفى وذلك خلال الفترة من أبريل إلى سبتمبر 2009م. لقد تم جمع البيانات من 200 مريض مصاب بداء السكري من النمط الثاني من المراجعين لعيادة السكري بالمستشفى وذلك باستخدام استبيان قصير لتقييم نوعية الحياة لدى مرضى السكري. ولقد قمنا أيضاً بتحليل المتغيرات الديموغرافية الاجتماعية، ومؤشر كتلة الجسم، والمقاييس السريرية المرتبطة بتشخيص السكري من النمط الثاني بما فيها مستويات الهيموغلوبين السكري، وأُجرينا التحليل الإحصائي بواسطة برنامج التحليل الإحصائي.

النتائج: أشارت الدراسة إلى أن نتائج استبيان تقييم نوعية الحياة بين المرضى الذين كانت مدة إصابتهم بالمرض أقل من 5 سنوات وكانت نسبة الهيموجلوبين المرتبط بالسكر لديهم أقل من 8% قد كانت إيجابية بالمقارنة مع المرضى الآخرين. كما أظهرت النتائج تحسن نتائج الاستبيان بين المرضى المصابين بداء السكري والذين تقل أعمارهم عن 40 عاماً وذلك بالمقارنة مع المرضى الآخرين.

خاتمة: توضح الدراسة بأن المرضى العمانيين المصابين بداء السكري من النمط الثاني يتمتعون بنوعية حياة ذات مستوى متوسط عموماً. كما يلعب عمر المريض، ومدة الإصابة بالمرض، ومعدل الهيموجلوبين السكري دوراً هاماً في تحسين نوعية الحياة من النمط الثاني، حيث لوحظ أنه عند انخفاض عمر المريض، ومدة الإصابة، ومعدل الهيموجلوبين السكري فإن نوعية الحياة تتحسن بشكل ملحوظ.

Objectives: To measure quality of life of type 2 diabetes patients in Oman, and examine which patients' socio-demographic and diabetes-related clinical characteristics are associated with better quality of life.

Methods: This cross-sectional study of 200 diabetic subjects was conducted in Sultan Qaboos University Hospital, Al-Khod, Oman between April and September 2009. A short form of the diabetes quality of life questionnaire (DQoL) was used to elicit indices of quality of life on subjects (n=200) seeking consultation at the diabetic outpatient clinic. Socio-demographic variables, body mass index (kg/m) and clinical parameters relevant for the diagnosis of type 2 diabetes, including glycated hemoglobin A1c level, (HbA1c), were also sought.

Results: The results show that patients with less than 5 years of disease duration and HbA1c less than 8% reported significantly better overall DQoL. Patients with HbA1c less than 8% showed significantly higher glycemic control satisfaction score. The same trend was observed in patients with less than 5 years duration of diabetes. Patients with ages less than 40 years have significantly better self care adherence scores and total score of QoL.

Conclusion: Patients' reported moderate DQoL, which appears to be related to demographics, medical history, and management regimens. Patients with HbA1c less than 8% showed significantly higher glycemic control satisfaction score. Furthermore, patients who are less than 40 years of age have significantly better quality of life compared to other age groups.

The incidence of type 2 diabetes mellitus is becoming a global challenge with all the negative repercussions in term of morbidity and mortality.[1] The international Diabetes Federation (IDF) has projected that type 2 diabetes mellitus represents the fourth leading cause of global death.[2] Type 2 diabetes mellitus appears to be a silent epidemic in many parts of the world. This has been attributed to increasing longevity and to the negative repercussions of rapid urbanization and changing dietary and lifestyles.[3,4] Diabetes mellitus is trigged by multifactors, which lead to chronic complications such as blindness, amputation, neuropathy, nephropathy, and cardiovascular disease, and all the consequences these conditions may entail. Morbidity and mortality due to diabetes have a subtle but debilitating burden on individuals, and society which, in turn, create undue burden to public health.[5,6] There is evidence to suggest that diabetes is highly prevalent among the diverse ethnicity living in the Middle East.[7-9] In the Arabian Gulf, studies have reported that nearly 17% of adults in the United Arab Emirates,[10] 15% of Kuwaitis,[11] and 14% of Saudis[12] suffer from type 2 diabetes mellitus. Longitudinal studies in Oman have suggested that type 2 diabetes is becoming increasing common.[13] A recent study has suggested that approximately 11% of Oman's youthful population has type 2 diabetes mellitus.[7] Many studies in the Gulf regions have focused on epidemiology and quantification of complication, of diabetes.[1-12] To our knowledge, relevant correlates that have direct bearing on quality of life (Qol) are not forthcoming from this region, despite ample evidence that diabetic complications could be reduced and prevented among high-risk individuals.[8] There is an increasing awareness that the impact of chronic diseases, and their management must be evaluated in terms of their QoL as well as traditional measures of clinical outcomes such as morbidity and mortality.[14-17] Studies from many parts of the world suggest that patients with diabetes have a lower operationalized QoL than people with no chronic illness, but a better QoL than people with most other serious chronic diseases.[18,19] The duration and type of diabetes are related to QoL. Intensive diabetes therapy is shown to improve glycemic levels, which are associated with better QoL.[20] Complications resulting from diabetes are the most important diabetes-specific determinants of QoL.[21] Better diabetes QoL is associated with better levels of social support, self-efficacy, exercises, education level, income, and with the absence of complications.[14,15] There is also evidence to suggest that patients' QoL and treatment satisfaction improved after good glycemic control and greater perceived flexibility in leisure time activities and diet,[17,22] which in turn suggest the importance of QoL as prevention and prognostic indicators.

Identifying the key determinants of QoL and their effect on repercussion would likely shed light on prevention measures, devising intervention as well as formulating health policy, which, in turn would heighten the QoL of people with diabetes. Despite many epidemiological studies and clinical impressionistic observation, there are limited studies that examine the quality of people with diabetes in Arab population. In order to fill the gap in the literature, this study aim to measure QoL in Arab patients with type 2 diabetes in Oman, and examine which patient socio-demographic and diabetes-related clinical characteristics are associated with better QoL.

Methods. *Data source.* The study was conducted in Sultan Qaboos University Hospital in Oman between April and September 2009 as part of research on the effectiveness of medical nutritional treatment of type 2 diabetic patients. Interview questionnaires were used by trained dieticians to collect data from 200 type 2 patients with diabetes from the diabetic outpatient clinic of Sultan Qaboos University Hospital. Subjects were selected from the daily list of outpatient visits during the study period. Of the 235 total established clinic patients served by the clinic, 200 agreed to participate, resulting in 85.1% response rate. Data were collected by face-to-face interview with patients. Written informed consents were provided by all participating patients in the study in compliance with the principles of the 1996 amendment to the Declaration of Helsinki, and the study was approved by Sultan Qaboos University Hospital ethics committee.

The Diabetes Quality of Life (DQoL) instrument. The DQoL is a 60-item multiple-choice questionnaire with 4 subscales including indices of level of "satisfaction", "impact", "diabetes-related worry", and "social/vocational worry". In the original DQoL, lower scores indicated high QoL but other studies have reversed this.[23] The psychometric property of DQoL has been established in various populations.[23,24] For the present context, a short form of the DQoL questionnaire, which consisted of 15-items, derived from the 60-item DQoL.[25] The presently used shortened form aimed to elicit a total health related QoL score that predicts self-reported diabetes care behaviors and satisfaction with diabetes control, and its psychometric properties have been widely accepted.[25] There is added rationale for using the shortened version in the present clinical population because is it takes around 10 minutes to complete, conducive such a setting. The scores of all items were summed giving a total scale score resulting in a grand measure score, which ranged from 15-75. The grand measure score was divided by the number

of items, converting them into a score from 1-5 with higher scores indicating better QoL.

Statistical analysis. The data were analyzed using the Statistical Package for Social Sciences (SPSS inc, Chicago, IL, USA) computer software version 10.0. The descriptive data were expressed as mean ± standard deviation, frequency, median, and range. One-way analysis of variance (ANOVA) and unpaired t-tests were the key statistical tests used in this study. The level for significance was $p < 0.05$ for all tests.

Results. Social demographic and clinical parameters of the study population are presented in **Table 1**. The mean age of the patients (126 female, 74 male) was 53.6±9.5 years. Most respondent patients were female, married, living with their families, had low level of education, had a family history of diabetes mellitus, had longer duration of diabetes mellitus, were overweight and had poor glycemic control. Sixty-six percent of patients reported no complications associated with diabetes.

Table 2 shows the key determinants of DQoL in Omani type 2 diabetic patients. "Satisfaction with diabetes control" subscale had a higher mean score (3.617). The mean score of "self care adherence" was slightly lower than the satisfaction subscale (3.594). The highest mean scores in the satisfaction with diabetes control subscale of the DQoL were "satisfaction with time spent getting checkups for diabetes" 4.08 and "satisfaction with the amount of time it takes to manage diabetes" (3.98). The type 2 patients with diabetes studied were found to be moderately satisfied with their management and current treatment of diabetes, and moderately worried regarding whether they will pass out. Less satisfaction was reported on having pain because of the diabetes treatment. Satisfaction with exercising time had the lowest mean score (2.91). The self care adherence scale items that had the highest impact on patients included the following: satisfaction with sugar maintenance (4.02), how often does the patient break the diet to avoid telling others about their diabetes (3.98). Respondents were moderately satisfied with their knowledge of diabetes (3.65). On the other hand, the least self care adherence item was participant's satisfaction over time spent exercising (2.91). Type 2 patients were much more worried over missing work due to their diabetes mellitus (3.33).

As shown in **Table 2**, the mean total DQoL score was higher among Omani type 2 patients aged less than 40 years, male, single, had more than 6 years of education, and had no family history of diabetes. Patients less than 40 years of age had significantly higher total QoL

($p < 0.05$). Male patients had a higher satisfaction score compared to female patients, but the difference was insignificant. Omani type 2 patients who lived alone and have primary school education or more have significantly better DQoL ($p < 0.05$).

Table 3 showed that Omani type 2 patients with less than 5 years of disease duration and had hemoglobin A1c level (HbA1c) less than 8% had reported significantly better overall DQoL. Patients with HbA1c <8 showed significantly higher glycemic control satisfaction score. The same trend was observed in patients with less than 5 years duration of diabetes.

Table 1 - Socio-demographic and clinical characteristics of 200 Omani type 2 diabetes mellitus patients.

Categories	n	(%)
Gender		
Male	74	(37.0)
Female	126	(63.0)
Age (years)		
Male	52.4±9.7	
Female	54.4±9.3	
Living status		
Living with family	193	(96.5)
Living alone	7	(3.5)
Marital status		
Married	149	(74.5)
Single	8	(4.0)
Divorced	14	(7.0)
Spouse died	29	(14.5)
Education status		
Illiterate	74	(37.0)
Literate	42	(21.0)
Primary school	34	(17.0)
High school	26	(13.0)
University graduate	24	(12.0)
Family history of diabetes		
Yes	112	(56.0)
No	88	(44.0)
Duration of diabetes (years)		
<5	67	(33.5)
≥5	133	(66.5)
Body Mass Index (kg/m²)		
<25	93	(46.5)
≥25	107	(53.5)
Glycated hemoglobin (%)		
<7	65	(32.5)
7-8	58	(29.0)
≥8	77	(38.5)
Treatment of diabetes		
Diet	36	(18.0)
Oral hypoglycemic drugs	97	(48.5)
Insulin	67	(33.5)
Microvascular complications		
Retinopathy	16	(8.0)
Neuropathy	32	(16.0)
Nephropathy	20	(10.0)
No complication	132	(66.0)

n= number of subjects

Table 2 - Key determinants of diabetes quality of life (DQoL) in Omani type 2 diabetic patients (socio-demographics characteristics) (N=200).

Socio-demographics characteristics	Satisfaction	Self care	Total DQOL
		Mean± SD	
Age			
≤40	3.781±0.462	3.792±0.331*	3.742±0.411*
>40	3.592±0.471	3.578±0.436	3.501±0.453
Gender			
Males	3.638±0.425	3.606±0.362	3.560±0.397
Females	3.589±0.498	3.587±0.468	3.498±0.483
Marital status			
Single	3.854±0.483	3.771±0.295	3.800±0.436
Married	3.583±0.461	3.577±0.412	3.508±0.437
Divorced	3.690±0.418	3.643±0.433	3.605±0.368
Spouse passed away	3.621±0.542	3.609±0.551	3.467±0.559
Education			
<6 years	3.549±0.471	3.549±0.463	3.454±0.472
≥6 years	3.654±0.471	3.661±0.376	3.621±0.410*
Living status			
With family	3.592±0.455	3.581±0.419	3.506±0.441
Alone	4.000±0.752*	3.952±0.629*	3.924±0.619*
Family history of diabetes			
Yes	3.613±0.478	3.563±0.417	3.517±0.453
No	3.598±0.466	3.634±0.448	3.525±0.456

n= number of subjects, SD= standard deviation, *significant difference ($p<0.05$)

Table 3 - Key determinants of diabetes quality of life (DQoL) in Omani type 2 diabetic patients (clinical characteristics) (N=200).

Clinical characteristics	Satisfaction	Self care	Total DQoL
		Mean± SD	
Duration			
<5 years	3.714*±0.0510	3.667±0.471	3.601*±0.484
≥5 years	3.553±0.444	3.558±0.407	3.465 ±0.428
Body mass index			
<25	3.627±0.468	3.591±0.431	3.491±0.450
≥25	3.589±0.477	3.597±0.434	3.546±0.456
Complications			
None	3.634±0.492	3.612±0.462	3.556±0.473
Neuropathy	3.552±0.457	3.583±0.386	3.436±0.416
Retinopathy	3.687±0.421	3.552±0.429	3.546±0.460
Nephropathy	3.450±0.371	3.525±0.288	3.403±0.348
Hospitalization			
Never	3.613±0.466	3.600±0.432	3.540±0.440
One or more	3.590±0.490	3.579±0.433	3.476±0.485
Treatment			
Diet	3.676±0.521	3.630±0.520	3.572±0.508
Oral hypoglycemic agents	3.644±0.453	3.612±0.419	3.572±0.508
Insulin	3.515±0.464	3.550±0.399	3.466±0.458
Glycated hemoglobin			
<7	3.726*±0.424	3.621±0.423	3.613*±0.422
7-8	3.624±0.536	3.629±0.491	3.545±0.508
>8	3.494±0.436	3.545±0.390	3.424±0.421

n= number of subjects, SD - standard deviation, *significant difference ($p<0.05$)

Discussion. Subjects' QoL, total physical, mental, and social support have come to be viewed as critical outcomes of disease treatment and control. Consequently, generic and disease-specific DQoL measures have been used extensively in clinical trials and research initiatives to assess the impact of certain medical conditions.[26] In the instances of diabetes mellitus, self-management or changing lifestyle which has direct relevance to metabolic control often has better functional prognosis as measured by indices of DQoL.[27] With the emergence of life-style diseases such as diabetes mellitus in many developing countries, healthcare workers should capitalize opportunities in educating people with diabetes mellitus to maintain a good glycemic control of their diabetes. The net benefit for this is to impact clinical outcomes. This study provides information regarding DQoL and its assessment among Omani type 2 patients with diabetes. The data suggest that diabetes mellitus has a strong impact on the studied subjects DQoL. Consistent with previous reported research, patients with type 2 diabetes with a duration of disease more than 5 years and HbA1c ≥ 8% reported lower satisfaction levels.[28] Similar results were found in Dutch type 2 individuals, where higher HbA1c levels were negatively associated with DQoL.[28] In the same study they found that type 2 patients with higher HbA1c levels were less satisfied with the treatment than other patients. Another study the assesses health-related QoL of subjects with type 2 diabetes in Turkey found similar results.[29] In this study, type 2 patients less than 40 years of age have significantly better self care adherence scores as well as total score of QoL. These results indicate better awareness among Omani type 2 patients.

In our study, single diabetic individuals reported insignificantly better DQoL, higher satisfaction with diabetes control, and better self care adherence scores. Patients who had lost their spouse showed the lowest total DQoL, satisfaction, and self-care adherence scores compared with the rest. This may indicate a good social network support in the Omani community. This can be attributed to the close and mutual relationship of the Omani community, its cultural characteristics and traditions toward family ties and supportive attitudes. Social support has a positive influence on physical and psychological well-being of patients, which is reflected in better QoL. Social support empowers patient's individual attitudes with the end result of enhancing QoL and reducing the severity of illness.[30]

Patients of the present study, with 6 years of education, have significantly better QoL compared with other patients who do not have the same level of education. Patient education empowers self-management of diabetes and has become a cornerstone of quality oriented diabetic care. A randomized controlled study assessing learning, problem solving ability, and QoL in people with type 2 diabetes stated that better education of patients with type 2 diabetes can facilitate the patient's acquirement of specific knowledge and conscious behaviors that leads to knowledge, problem solving ability, and better QoL.[31] Good psychosocial support is associated with more favorable clinical outcomes.

In conclusion, overall, Omani type 2 patients with diabetes reported moderate DQoL, which appears to be associated with lifestyle options, education level, and other disorders related to diabetes and obesity. In summary, patients with HbA1c less than 8% showed significantly higher glycemic control satisfaction score. Furthermore, patients who are less than 40 years of age have significantly better QoL compared to other age groups. This work will help in providing useful information to health providers and physicians for better and comprehensive management of diabetes.

The present study has several limitations. Our study did not include some relevant information such as household income, working hours, and social support. This information can help in understanding the factors that can affect the QoL for diabetic patients. An other limitation of this study is that we did not have data on the presence of diabetic complications/co-morbid conditions. Therefore, we cannot generalize these results to other populations of patients who are seeking treatment for diabetes. This study was a cross-sectional design and therefore cannot determine causality. Longitudinal studies assessing the natural history of diabetes and QoL are needed to draw firm conclusions on the causal pathway of these associations.

The present study has several implications. Quality of life of patients is an essential factor that affects diabetic management and therefore, the ultimate diabetic care should involve the assessment of QoL in any modality used to treat diabetic patients. Although this study showed interesting results in a special group of Omani patients, more studies are needed in other parts of Oman, including larger study populations in order to help the researchers and policy makers provide the proper health care programs for diabetic patients in Oman.

References

1. World Health Organization. The World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva (SW): WHO; 2002.
2. International Diabetes Federation (IDF). Facts and figures, did you know? [Accessed on 2007 May 22; Updated on 30 September 2011]. Available from: http://www.idf.org/

3. Cherrington AD. 2005 Presidential Address: Diabetes: past, present, and future. *Diabetes Care* 2006; 29: 2158-2164.

4. Al-Lawati JA, Al Riyami AM, Mohammed AJ, Jousilahti P. Increasing prevalence of diabetes mellitus in Oman. *Diabet Med* 2002; 19: 954-957.

5. El Achhab Y, Nejjari C, Chikri M, Lyoussi B. Disease-specific health-related quality of life instruments among adults diabetic: A systematic review. *Diabetes Res Clin Pract* 2008; 80: 171-184.

6. Hirsch A, Bartholomae C, Volmer T. Dimensions of quality of life in people with non-insulin-dependent diabetes. *Qual Life Res* 2000; 9: 207-218.

7. Mabry RM, Reeves MM, Eakin EG, Owen N. Gender differences in prevalence of the metabolic syndrome in Gulf Cooperation Council Countries: a systematic review. *Diabet Med* 2010; 27: 593-597.

8. Alwakeel JS, Sulimani R, Al-Asaad H, Al-Harbi A, Tarif N, Al-Suwaida A, et al. Diabetes complications in 1952 type 2 diabetes mellitus patients managed in a single institution in Saudi Arabia. *Ann Saudi Med* 2008; 28: 260-266.

9. Saadi H, Carruthers SG, Nagelkerke N, Al-Maskari F, Afandi B, Reed R, et al. Prevalence of diabetes mellitus and its complications in a population-based sample in Al Ain, United Arab Emirates. *Diabetes Res Clin Pract* 2007; 78: 369-377.

10. Al-Adsani AM, Moussa MA, Al-Jasem LI, Abdella NA, Al-Hamad NM. The level and determinants of diabetes knowledge in Kuwaiti adults with type 2 diabetes. *Diabetes Metab* 2009; 35: 121-128.

11. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harthi SS, Arafah MR, Khalil MZ, et al. Diabetes mellitus in Saudi Arabia. *Saudi Med J* 2004; 25: 1603-1610.

12. Al-Lawati JA, Tuomilehto J. Diabetes risk score in Oman: a tool to identify prevalent type 2 diabetes among Arabs of the Middle East. *Diabetes Res Clin Pract* 2007; 77: 438-444.

13. Schwarz PE. Public health implications: translation into diabetes prevention initiatives--four-level public health concept. *Med Clin North Am* 2011; 95: 397-407.

14. Clark M. Diabetes self-management education: a review of published studies. *Prim Care Diabetes* 2008; 2: 113-120.

15. Orsenigo E, Fiorina P, Cristallo M, Socci C, La Rocca E, Maffi P, et al. Long-term survival after kidney and kidney-pancreas transplantation in diabetic patients. *Transplant Proc* 2004; 36: 1072-1075.

16. Hahl J, Hämäläinen H, Sintonen H, Simell T, Arinen S, Simell O. Health-related quality of life in type 1 diabetes without or with symptoms of long-term complications. *Qual Life Res* 2002; 11: 427-436.

17. Anderson RT, Skovlund SE, Marrero D, Levine DW, Meadows K, Brod M, et al. Development and validation of the insulin treatment satisfaction questionnaire. *Clin Ther* 2004; 26: 565-578.

18. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harthi SS, Arafah MR, Khalil MZ, et al. Diabetes mellitus in Saudi Arabia. *Saudi Med J* 2004; 25: 1603-1610.

19. Nimsgern A, Camponeschi J. Implementing a new diabetes resource for Wisconsin schools and families. *Prev Chronic Dis* 2005; 2: A11.

20. Martha M, Funnell A. Quality of Life and Insulin Therapy in Type 2 Diabetes Mellitus. *Insulin* 2008; 3: 31-36.

21. Orsenigo E, Fiorina P, Cristallo M, Socci C, La Rocca E, Maffi P, et al. Long-term survival after kidney and kidney-pancreas transplantation in diabetic patients. *Transplant Proc* 2004; 36: 1072-1075.

22. Burroughs TE, Desikan R, Waterman B, Gilin M, McGill DJ. Development and Validation of the Diabetes Quality of Life Brief Clinical Inventory. *Diabetes Spectrum* 2004; 17: 41- 49.

23. Hara Y, Koyama S, Morinaga T, Ito H, Kohno S, Hirai H, et al. The reliability and validity of the Japanese version of the Appraisal of Diabetes Scale for type 2 diabetes patients. *Diabetes Res Clin Pract* 2011; 91: 40-46.

24. Acquadro C, Conway K, Hareendran A, Aaronson N; European Regulatory Issues and Quality of Life Assessment (ERIQA) Group. Literature review of methods to translate health-related quality of life questionnaires for use in multinational clinical trials. *Value Health* 2008; 11: 509-521.

25. Huang IC, Hwang CC, Wu MY, Lin W, Leite W, Wu AW. Diabetes-specific or generic measures for health-related quality of life? Evidence from psychometric validation of the D-39 and SF-36. *Value Health* 2008; 11: 450-461.

26. Braun A, Sämann A, Kubiak T, Zieschang T, Kloos C, Müller UA, et al. Effects of metabolic control, patient education and initiation of insulin therapy on the quality of life of patients with type 2 diabetes mellitus. *Patient Educ Couns* 2008; 73: 50-59.

27. Redekop WK, Koopmanschap MA, Stolk RP, Rutten GE, Wolffenbuttel BH, Niessen LW. Health-related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes. *Diabetes Care* 2002; 25: 458-463.

28. Akinci F, Yildirim A, Gözü H, Sargin H, Orbay E, Sargin M. Assessment of health-related quality of life (HRQoL) of patients with type 2 diabetes in Turkey. *Diabetes Res Clin Pract* 2008; 79: 117-123.

29. Yildirim A. Health-related quality of social life. *Gulhane Medical Journal* 2002; 44: 480-485.

30. Trento M, Passera P, Borgo E, Tomalino M, Bajardi M, Cavallo F, et al. A 5-year randomized controlled study of learning, problem solving ability, and quality of life modifications in people with type 2 diabetes managed by group care. *Diabetes Care* 2004; 27: 670-675.

31. Isao S, Fujiko I, Toshiko I, Chinatsu M, Akiko T, Kunio Y, Hideki O. Impact of diabetes on health-related quality of life in a population study in Japan. *Diabetes Res Clin Pract* 2006; 19: 163-173