Factors Influencing Dietary Practice among Type 2 Diabetics

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Background: Improving dietary practice alone without the adherence to other diabetic self-management elements can improve glycemic control and may reduce glycosylated hemoglobin (HbA1c) by 1% to 2%. However, diabetic patients usually have poor adherence to follow appropriate and long-term dietary practice.

Objective: To evaluate the factors influencing dietary practice and to evaluate the relationship between patients' dietary practice and level of HbA1c.

Design: A cross-sectional study.

Setting: Five Health Centers, Bahrain.

Method: The study was performed in Bahrain during 2011; it included 400 type 2 diabetic patients. The sample was selected from the diabetic clinics of the primary health care centers. Only the adult patients who attended the clinic at least twice were included in the study.

Result: The majority of the sample was 50 years old with low educational level. Most of them were overweight and obese and had poor HbA1c level (>7%). However, patients had good family support and high motivation to see a dietician and to follow diet regimen if given. Despite all previous indications to reinforce diabetic self-management education, specifically dietary advice, 56 (14%) denied receiving any dietary advice. The majority received their dietary advice from doctors and only 65 (16.3%) received advice from the diabetic nurse. Most patients never have been referred neither to a dietician nor to a health educator (318 (79.5%), 338 (84.5%) respectively). Although, patients had mainly average and good dietary practice, it may not indicate the actual dietary habits of the studied patients due to some limitations in the study. The two main barriers to dietary regimen are "it takes efforts" were 183 (45.8%) and "being busy" were 178 (45.5%).

Conclusion: Although the majority of the diabetic patients were poorly controlled, most had average and good dietary practice score. There was positive relationship between the dietary practice and the HbA1c level. The lack of proper professional dietary assessment, follow-up and advice by the health care providers are the main influence on dietary practice of type 2 diabetic patients in Bahrain.

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Diabetes mellitus is the most common serious metabolic chronic disease. In 2003, 194 million people aged 20 to 79 years worldwide had diabetes, but it is expected to increase to 333 million by 2025[1]. In 2006, the developing countries accounted for 141 million people with diabetes, which is 72.5% of the totally affected in the world[1]. According to the International Diabetes Federation, it is expected that the number of people with diabetes will double in three of the six developing regions: the Middle East and North Africa, South Asia and Sub-Saharan Africa[2]. Type 2 diabetes mellitus accounts for approximately 85-95% of all diagnosed cases of diabetes and Bahrain is rated one of the six countries of the Middle East and North Africa (MENA) region with the highest prevalence of diabetes (14.4%)[2]. According to the 2007 national non-communicable diseases risk factors survey in Bahrain, the prevalence of hyperglycemia was 13.5% and the impaired glucose tolerance was 12%[3].

WHO found that diabetes reduces both quality of life and life expectancy and imposes large economic burdens on individuals and on national health care system. Direct medical costs include resources used to treat the disease and the indirect are those related to loss of productivity caused by morbidity, disability and premature mortality[1].

Interventions to achieve good glycemic control in diabetic patients are cost effective method in reducing morbidity and mortality; however, glycemic control is poor in both developed and developing countries[1]. A Swedish survey in 2005 found that only 34% of the studied type 2 diabetic patients had good glycemic control (HbA1c <7%)[4]. In India the mean level of HbA1c in diabetic patients was 8.9%[5]. In UAE only 38% of patients had good glycemic control[6]. While, there are limited data available in Bahrain regarding reliable figures about the prevalence of uncontrolled type 2 diabetics, a study in 2006 showed that only 11.2% of type 2 diabetic patients had controlled HbA1c[7]. Another study showed comparable data (13.5%)[8].

Glycemic control is achieved by undertaking and sustaining a complex array of self-care behaviours, including four main domains: taking medications, sustaining appropriate dietary practice, engaging in regular exercise and self-monitoring of blood glucose levels[9,10]. Few studies added other components, such as foot care and attending diabetic clinic regularly[11]. However, appropriate dietary practice is a basic and integral part in treating diabetes mellitus and can reduce the development of disease complications by improving risk profiles[6]. If dietary practice and other self-care behaviours are improved, clinical and metabolic outcomes improve significantly[12].

Dietary practice refers to patients' choices in food consumption based on diabetes nutrition education that emphasizes on intake of lower fat, higher fibre, lower sodium and food that have health-promoting properties, such as omega-3 fatty acid rich fish, soy products, fresh or frozen fruits and vegetable[13].

Dietary practice assessment in type 2 diabetic patients should involve a thorough evaluation of the following: the usual eating pattern i.e. type and amount of food and beverages consumed, times of eating including meal and snack distribution throughout the day, current energy, macronutrient and micronutrient intake. It includes, weight history, body mass index (BMI) and target weight, food, nutrition and diabetes knowledge, history of diets followed in the past and success attained, food preparation and handling skills, food preparation facilities, food allergies, intolerances, personal food preferences, food insecurity, cultural, ethnic, socioeconomic considerations, current method of coordinating eating and glycemic control, review the results of self monitoring of blood glucose and client readiness for change and client's personal priorities[14].

Many studies found that there is difficulty in adherence to diabetic diet regimen[15]. Diabetics' dietary practice is influenced by psycho-socioeconomic factors, ranging from proximal factors, such as perceived barriers and personal challenges from family and friends, to more distal factors including health care team, work site, organizational and community barriers[15,16].

In the Arab countries, sedentary lifestyle, inappropriate diet, as well as insufficient and ineffective programs to prevent and control nutrition-related diseases are associated with non-communicable diseases and their complications[17].

The aim of this study is to evaluate factors affecting dietary practice among type 2 diabetic patients and the association between patients' dietary practice and their HbA1c level.

METHOD

The study was performed in five local health centres in the five health regions of Bahrain. Type 2 diabetic patients attending diabetic/non-communicable diseases (NCD) clinic was included. These clinics are operated by diabetic nurses with or without family physicians who follow structured guidelines for diabetes care[18]. One health centre was chosen from each health region according to the highest attendance rate of type 2 diabetic patients[19]. Patients attended the diabetic/NCD clinics at least two times in 2010 and have the disease for at least one year.

The study was done during the first two weeks of June 2011. Each patient completed an interviewer-administered questionnaire. The personal characteristics and clinical data were collected from the patients' medical records. Four hundred type 2 diabetic patients representing the five regions were selected.

The study questionnaire was adapted from a previous research after obtaining author's permission[10]. An Arabic version of the instrument was developed. There were nine domains in the questionnaire; the personal and clinical characteristics, sources of dietary advice, dietary practice assessment, psychosocial factors (family support, motivation, confidence and satisfaction) and barriers to follow diet regimen. The questionnaire was pilot-tested on twenty-five type 2 diabetic patients; the results of the pilot study were not included in the main study. To improve the accuracy of dietary assessment section, the answer of each question was given a score from 0-2 and the total sum given a score from 0-34. The dietary practice was divided into five categories according to the results (0-6=very poor, 7-13=poor, 14-20=average, 21-27=good, 28-34=very good).

Family support was assessed using 6 questions; each was given a score from 0-2 and the total rating was 0-12 (0-3=poor, 4-8=average, 9-12=good). Motivation was assessed using two questions with a score each of 0-2 (willingness to see a dietician/health educator and readiness to follow a diet regimen if given). For the confidence in controlling the blood sugar, the patients were divided into three groups (not confident, confident to some degree, highly confident). Satisfaction with following diet regimen was also assessed by dividing the patients into three groups (not satisfied, satisfied to some degree, highly satisfied). Barriers to follow diet regimen (the patients are busy which limit their time to improve the dietary practice, following healthy diet regimen takes effort and difficult to accomplish, the patient forgets how to follow healthy diet regimen, the patient does not know if following a healthy diet regimen will help in controlling his/her blood sugar, the patient does not understand what to do to improve his/her dietary practice, improving dietary practice by following a healthy diet regimen costs extra money, the patient cannot follow a healthy diet regimen because he/she feels depressed/sad/anxious which affects his/her dietary habits and the patient doesn't like to change his/her usual dietary practice).

The data were analysed using SPSS version 17. Statistical significance was set at p-value <0.05. Verbal informed consents were taken from all the patients prior to the interview. All the information was dealt with the highest level of confidentiality and the questionnaires were destroyed after transferring the information into the software.

RESULT

Four hundred patients were included in the study, age range was 27 to 80 years (mean 54.7+9.95), 208 (52%) were females. The majority were Bahrainis, 340 (85%), 359 (89.8%) were married. Most of the participants were not working. Housewives were 165 (41.3%) and illiterate were 84 (21%), see table 1. The body mass index (BMI) ranged from 19.00 to 65.84 Kg/m^2 (mean 30.94+6.47 Kg/m^2).

Table 1: Personal Characteristics and Dietary Practice

Personal Characteristics		Number & percentage	Mean + SD	95% CI[a]	P-value[b]
Age Groups	<40 years	24 (6)	17.54 + 6.55	14.68-20.31	
	40-49 years	83 (20.8)	18.51 + 4.83	17.45-19.56	
	50-59 years	174 (43.5)	19.65 + 4.37	19.00-20.31	.000
	60-69 years	90 (22.5)	20.72 + 4.32	19.82-21.63	
	≥70 years	29 (7.3)	21.86 + 3.32	20.60-23.13	
	Total	400			
Gender	Male	192 (48)	19.69 + 4.24	19.09-20.30	.989
	Female	208 (52)	19.69 + 5.01	19.00-20.37	
	Total	400			
Nationality	Bahraini	340 (85)	19.50 + 4.77	18.99-20.01	
	Non-Bahraini	60 (15)	20.73 + 3.76	19.76-21.71	0.590
	Total	400			
Marital Status	Single	11 (2.8)	14.73 + 7.21	9.88-19.57	
	Married	359 (89.8)	19.78 + 4.54	19.31-20.25	
	Separated/Divorced	9 (2.3)	17.78 + 3.42	15.15-20.41	.000
	Widowed	19 (4.8)	21.68 + 3.68	19.91-23.46	
	Total	398*			
Employment Status	Employed full-time	126 (31.5)	19.29 + 4.78	18.44-20.13	
	Employed part-time	9 (2.3)	16.11 + 3.37	13.52-18.70	
	Self-employed	5 (1.3)	18.20 + 4.49	12.62-23.78	
	Unemployed	5 (1.3)	18.80 + 8.41	8.36-29.24	
	Housewife	165 (41.3)	20.26 + 4.62	19.54-20.97	.200
	Retired	78 (19.5)	19.72 + 4.29	18.75-20.69	
	Disabled, not able to work	2 (0.5)	21.50 + 3.54	-10.27-53.27	
	Other	10 (2.5)	19.30 + 4.27	16.25-22.35	
	Total	400			
Education Level	Illiterate	84 (21.1)	21.54 + 3.67	20.74-22.33	
	Did not finish secondary school but able to read and write	126 (31.5)	19.02 + 4.55	18.22-19.83	
	Secondary school graduate	123 (30.8)	18.64 + 4.68	17.81-19.48	.000
	College graduate	63 (15.8)	20.57 + 5.11	19.29-21.86	
	Post-graduate	3 (0.8)	22.00 + 5.20	9.09-34.91	
	Total	399*			

[a] 95% Confidence Interval for the mean of dietary practice score; [b] P-value between groups significant at the .05 level
* Missing data

Three hundred thirteen (78.6%) patients confirmed receiving dietary advice of whom 41.9% from their doctors, dieticians, diabetic nurses or health educators. Other sources (family, relatives and mass media) were not the main source of the dietary advice. About 14% denied receiving any dietary advice and a large number were never seen by a dietician 308 (77%) or by a health educator 327 (82.8%).

The mean duration since the diagnosis of diabetes was reported to be 10.51+7.73 years. Two hundred eighty-eight (72.2%) were on oral hypoglycemic and life style modification therapy, see table 2.

Table 2: Clinical Characteristics and Dietary Practice

Clinical Characteristics		Number & percentage	Mean ± SD	95% CI[a]	P-value[b]
BMI[20]	Normal weight	46 (11.7)	20.28 ± 5.71	18.59-21.98	
	Overweight	153 (39)	20.24 ± 4.31	19.55-20.92	
	Obese Class I	111 (28.3)	19.74 ± 4.41	18.90-20.57	.010
	Obese class II	44 (11.2)	18.89 ± 4.46	17.53-20.24	
	Obese class III	38 (9.7)	17.42 ± 5.16	15.72-19.12	
	Total	392*			
Duration	1-5 years	139 (34.8)	19.50 ± 4.95	18.67-20.33	
	6-10 years	99 (24.8)	20.15 ± 4.60	19.23-21.07	
	11-15 years	67 (16.8)	18.65 ± 4.41	17.57-19.74	.154
	16-20 years	50 (12.5)	19.74 ± 4.85	18.36-21.12	
	≥ 20 years	45 (11.3)	20.71 ± 3.65	19.62-21.81	
	Total	400			
Treatment	LSM only	14 (3.5)	21.43 ± 5.26	18.39-24.46	
	LSM + OHA	288 (72.2)	19.60 ± 4.56	19.08-20.13	
	LSM + Insulin injection	20 (5)	17.85 ± 5.60	15.23-20.47	.110
	LSM + OHA + Insulin injection	77 (19.3)	20.18 ± 4.55	19.14-21.22	
	Total	399*			

[a] 95% Confidence Interval for the mean of dietary practice score
[b] P-value between groups significant at the .05 level * Missing data

Two hundred twenty-six (56.5%) patients reported to have good family support. Three hundred thirty-six (84%) patients were highly motivated toward following a meal plan and to be seen by a dietician, 169 (42.3%) were highly confident in controlling their blood sugar and 175 (43.8%) were satisfied to some degree with following dietary regimen, see table 3.

Table 3: Psycho-Social Factors and Dietary Practice

Psycho-Social Factors		Number & percentage	Mean ± SD	95% CI[a]	P-value[b]
Family Support	Poor	11 (2.8)	17.82 ± 4.49	14.80-20.83	
	Average	163 (40.8)	18.87 ± 5.09	18.08-19.66	.003
	Good	226 (56.5)	20.37 ± 4.20	19.82-20.92	
	Total	400			
Motivation	Not motivated	13 (3.3)	21.00 ± 4.64	18.20-23.80	
	Motivated to some degree	51 (12.8)	17.82 ± 4.69	16.54-19.18	.008
	Highly motivated	336 (84)	19.92 ± 4.59	19.42-20.41	
	Total	400			
Confidence	Not confident	81 (20.3)	18.49 ± 4.80	17.43-19.54	
	Confident to some degree	149 (37.3)	18.83 ± 4.22	18.14-19.51	.000
	Highly confident	169 (42.4)	21.04 ± 4.62	20.34-21.75	
	Total	399*			
Satisfaction	Not satisfied	68 (17)	18.13 ± 4.69	16.99-19.25	
	Satisfied to some degree	175 (43.8)	18.96 ± 4.25	18.33-19.59	.000
	Highly satisfied	156 (39.1)	21.23 ± 4.62	20.50-21.96	
	Total	399*			

[a] 95% Confidence Interval for the mean of dietary practice score
[b] P-value between groups significant at the .05 level * Missing Data

Although the mean HbA1c level was 7.37+2% (range 3.15% to 13.90%), 53% were poorly controlled. The mean dietary practice score was 19.69+4.65 and the majority were having either average or good dietary practice. Statistical analysis showed significant positive relationship between dietary practice and the level of HbA1c (P-value .001), see figure 1 and table 4.
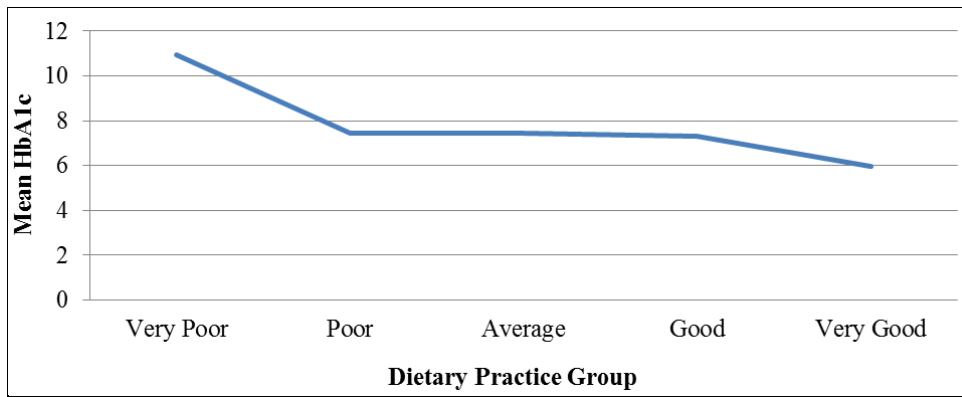
Figure 1: The Relation between Dietary Practice Group and HbA1c Level

Table 4: Dietary Practice and HbA1c Level

Dietary Practice		Mean ± SD	95% CI^a	p-value^b
	Dietary practice score	19.69 ± 4.65	19.23-20.15	
HbA1c level	Mean HbA1c	7.37 ± 2	7.17-7.56	
Dietary Practice	Very poor 2 (0.5)	10.95 ± 1.56	-3.03-24.93	.006
	Poor 40 (10)	7.46 ± 1.74	6.90-8.01	
	Average 185 (46.4)	7.46 ± 1.97	7.17-7.43	
	Good 157 (39.3)	7.31 ± 2.07	6.98-7.64	
	Very good 15 (3.8)	5.97 ± 1.36	5.22-6.73	
	Total 399*			
HbA1c Level	Excellent 69 (17.3)			
	Good 42 (10.6)			
	Fair 76 (19.1)			
	Poor 211 (53)			
	Total 398*			

^a 95% Confidence Interval for the mean of dietary practice score
^b P-value between groups significant at the .05 level * Missing data

Many factors such as age, marital status and level of education had a significant relationship with the dietary practice (P-value .000), see table 1. This was true for BMI (P-value .010), family support (P-value .003), motivation (P-value .008), confidence (P-value .000) and satisfaction (P-value .000); see tables 1, 2 and 3.

Other barriers were as follows: 183 (45.8%) "following diet regimen takes effort", 178 (45.5%) "being busy"; these were the main two perceived obstacles preventing the diabetic patients from following diet regimen, see table 5.

Table 5: Barriers to Follow Diet Regimen

Barriers	Number & percentage		Mean ± SD	P-value[b]
Being busy	Yes	178 (45.8)	18.40 ± 4.46	
	No	211 (54.2)	20.74 ± 4.51	.000
	Total	389*		
Do not like it	Yes	121 (31.8)	17.41 ± 4.39	
	No	259 (68.2)	20.86 ± 4.46	.000
	Total	380*		
Forget how to do it	Yes	122 (31.5)	18.36 ± 4.33	
	No	265 (68.5)	20.34 ± 4.61	.000
	Total	387*		
Do not understand what to do	Yes	103 (26.6)	18.27 ± 4.44	
	No	284 (73.4)	20.17 ± 4.65	.000
	Total	387*		
It takes efforts	Yes	183 (47)	19.15 ± 4.62	
	No	206 (53)	20.33 ± 4.45	.011
	Total	389*		
Not sure if it helps	Yes	59 (15.3)	18.44 ± 4.74	
	No	326 (84.7)	19.99 ± 4.59	.018
	Total	385*		
Sad/depressed/ anxious	Yes	134 (34.8)	19.09 ± 4.95	
	No	251 (65.2)	20.08 ± 4.44	.046
	Total	385*		
Costs extra many	Yes	123 (31.8)	19.15 ± 4.42	
	No	264 (68.2)	20.04 ± 4.64	.077
	Total	387*		

[b] P-value between groups significant at the .05 level * Missing data

DISCUSSION

Several studies dealt with factors, which might influence compliance and adherence to dietary regimen including patients' personal and psycho-socio-economic characteristics[6,21-25].

There was significant association between dietary practice and HbA1c level, which is consistent with findings of other international and Middle East studies[6,12].

According to Bahrain and American Diabetes Association's guidelines for the management of diabetes mellitus, all diabetic patients at time of diagnosis, must be provided with an access to a dietitian/nutritionist or other health-care professional trained in the principles of nutrition who will offer an initial consultation with two or three follow-up sessions, either individually or in groups[26,27]. However, it was found that many of the studied diabetic patients did not receive dietary regimen advice from any source since the diagnosis. But many of them had the doctors as the main source of dietary advice, which was consistent with other studies[6].

The majority of the patients in this study denied being seen by any health educator since their diagnosis. Only few patients had been given dietary advice by the diabetic nurse. These findings indicate that the level of services provided are still below the recommended standards in Bahrain, even after implementing the diabetic/NCD clinic services within the primary health care system[23].

Unlike what was reported in other studies, it was found that older age groups had better dietary practice[28]. Possible explanation is that older patients may have problems recalling their dietary practice; hence, they tend to overestimate their adherence to diet regimen. In addition, patients' good family support possibly contributed in improving dietary practice in older age groups. Singles had the lowest dietary practice score and widowers scored the highest. No clinical relationship were established between the educational level and dietary practice despite the findings from previous studies indicating that low level of education leads to inadequate

knowledge about diabetes, which might lead to poor self-care practice[29]. Gender, nationality, and employment were not significantly associated with dietary practice.

Obesity could complicate diabetes management. Evidence showed that weight loss improves glycemic control[30]. Achieving and maintaining this goal is done by lifestyle modification, improving dietary practice combined with increased physical activity and behavioural therapy. In our study, most of the diabetic patients were either overweight or obese which reflects a major health risk requiring attention to be given to their dietary practice. The study showed an inverse relation between BMI and dietary practice. The duration of disease and type of treatment showed no significant differences between the groups and their means of dietary practice.

Diabetic patients, who reported good family support, had good dietary practice score[25]. This finding is consistent with other studies[31,32].

A study was done to assess the relationship between motivation and glycemic control in diabetic found that patients at an earlier motivational stage had lower HbA1C levels than those at later stages[33]. Highly confident diabetic patients have good dietary practice. The high level of satisfaction was also found to be significantly associated with higher dietary practice score. Highly satisfied diabetic patients have good dietary practice score; this finding is consistent with other studies[17].

Patients' personal perception and culture might affect diabetes self-management[16,21,23,34,35]. Identifying those barriers in our region may help to overcome obstacles to improve dietary practice. Eight barriers to follow diet regimen were studied in our research. Diet regimen "takes effort" and "patients being busy" were the main obstacles reported and they were significantly associated with dietary practice score.

The assessment of dietary practices was based on self-reported dietary habits rather than direct observation. This might have led to under-reporting and recall bias that could be a limitation of this study; hence, the interpretation of the results. Assessment of dietary practice was done using general dietary questions and not detailed accurate portion assessment, which might have contributed to under-estimation. Associated co-morbidities and other confounding factors were not studied, which might have played a role in raising the dietary practice score.

CONCLUSION

The majority of the studied patients were having poorly controlled type 2 diabetes mellitus although they obtained high dietary practice score reflecting average and good dietary practice. There was a significant relation between the dietary practice and the level of HbA1c. Lack of professional dietary assessment, follow-up, advice and motivation are the main factors that led to minimal improvement in the patients' dietary practice. Advancing age is a possible factor that might positively influence the dietary practice. Obesity was linked with lower dietary practice score, complicating diabetes self-management. None of the perceived barriers studied had major influence on the diabetic patients in Bahrain except "diet regimen takes effort and patients being busy".

Recommendations:

Active assessment of patients' understanding during educational sessions or clinic consultation might influence self-care, especially elderly patients or those with limited education. Dietary workshops in small groups will be beneficial. The media should be more

actively involved in educational programs. Multidisciplinary practice should be implemented; tasks should be divided between healthcare professionals including family physician, diabetic nurse, dietician/nutritionist and health educator.

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