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Original Article

Metabolic Control, Nutrition Knowledge, Attitude and Practice in Non-Insulin-dependent Diabetic Patients from Kohgiluyeh and Boyer-Ahmad Province, South-West of Iran

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ABSTRACT

Background and Objectives: Diabetes mellitus is among the most common causes of mortality in the world and an important risk factor for chronic kidney disease, foot amputation, ischemic heart disease and blindness among older adults. Diabetic patients mostly develop hyperlipidemia, which can result in cardiovascular diseases. Patient's knowledge, attitude and practices toward diet are the core center for diabetes control and affect their metabolic control and complications. In the present study, we measured nutritional knowledge, attitude and practices and their relations to serum lipids, HbA1C, and fasting blood glucose in diabetic patients of Boirahmad County, southwest of Iran, where many people encounter increasing prevalence of diabetes.

Materials and Methods: 198 IDDM patients from the rural and urban areas of Boirahmad County were invited to the health centers to be checked for their fasting blood glucose, serum total cholesterol, serum HDL cholesterol, serum triglyceride and also serum glycosylated hemoglobin. Their knowledge, attitude, and practices toward the diabetic diet were assessed using a validated questionnaire. The obtained scores were classified into three categories (Poor, average, and Good) to show their knowledge, attitude and practice levels, and the serum parameters were compared between the levels to show the relevancies.

Results: Our data showed that the patients' knowledge and attitude on diabetic nutrition are mostly at the average level (79.3% and 47.1%, respectively) but their practice scores are mostly at the poor level (43.8%), and just a minor proportion of the patients are at the appropriate levels (15.3, 33, and 23.1% of knowledge, attitude and practices, respectively). In addition, we found a significant reverse relationship between the patients' nutritional knowledge and serum HbA1C ($p=0.003$), and also between their attitude and serum triglyceride ($p<0.05$).

Conclusions: Our data suggest that the knowledge, attitude and practices of diabetic patients in Boirahmad are not satisfying; also it is necessary to run interventional studies to find the best educational methods to improve, control and manage the diabetics in this area.

Keywords: Diabetes Mellitus, Metabolic control, Knowledge, Attitude, Practice, Nutrition

Introduction

Diabetes mellitus is among the five main causes of global mortality (1) and its prevalence is increasing continuously, predicted to involve more than 353 million people in 2030 (2). This disorder is on of important leading threats to human health (3) and causes serious health complications including limb amputation, blindness, renal failure and cardiovascular diseases (CVDs). It further imposes

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economic burden (3, 4). Diabetes management depends on the patients' ability to self-care, and therefore, their knowledge, attitude and practices toward diabetes care (5). The quality of patients' knowledge, attitude and practices differs based on different cultural and economic basis, and may have different effects on diabetes control. Previous research reported increasing diabetes prevalence of 8.7% - 24% (6-9) different regions and groups of Iran. In addition studies on knowledge, attitude and practices toward diabetes management and control have already showed inconsistent results in different parts of Iran (10-14). While some studies reported optimum conditions in knowledge, attitude and practice toward diabetes (10), others suggest insufficient knowledge, attitude and practices (12-15). According to previous studies undiagnosed diabetes and poor diabetes management are big challenges in Iran (4). Nutritional knowledge, attitude and practices of diabetic patients have central role in diabetes management. Therefore, diabetes education is one of the policies that governments implement to control and manage diabetes (16). However, the effects of these educations are not elucidated, and little is known about their effectiveness in improving diabetic control. Hence, we determined nutritional knowledge, attitude and practices of Boirahmad County's diabetic patients who referred to the urban and rural health centers, and evaluated their association with the patient's metabolic control.

Materials and Methods

Sample size: Assuming 85% undesired metabolic control that was estimated in a pilot study consisting of 30 diabetic patients (p=0.85), 95 % confidence interval ($Z_{1-\alpha/2}$=1.96) and 0.05 % error of estimate (d=0.05), the calculated sample size was 196 diabetic patients. The formula used is: $n=z^2p\ (1-p)/d^2$.

Procedures: The study was carried out from spring to summer of 2014. Some 198 patients, who were registered in Boirahmad rural and urban health centers as independent diabetic mellitus patients, included in the study. Patients having more than 30 years of age and with diabetes history more than one year were regarded as eligible subjects. After describing the study objectives to the patients, those who were agreed to participate in the study, filled in a structured KAP questionnaire. For illiterate patients, the questions were orally asked, and their responses were filled in by a general practitioner. After overnight fasting, 5mL of their venous blood was sampled and sent to the laboratory to measure their fasting blood glucose, serum HbA1C, total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides. Fasting blood glucose higher than 130 mg/dl, LDL-C higher than 100 mg/dl, HDL-C lower than 40 for women and lower than 50 for men, and triglycerides higher than 150 mg/dl were regarded as abnormal in patients (14).

Questionnaire: After discussions on some other Persian and Non-Persian questionnaires, the KAP questionnaire was designed based on the cultural and nutritional characteristics of Boirahmadian people. The KAP questionnaire content validity was approved by nutritionist expert panel, and its reliability was determined by test-retest method and computing Pearson's correlation (r=0.73 p<0.0001 for knowledge, r=0.78 p<0.0001 for attitude and r=0.7، p<0.0001 for practice). Also Cronbach's alpha was computed to test the internal consistency of the questionnaire. Cronbaach's alpha coefficient of the questionnaire was 0.70, 0.83 and 0.76 for knowledge, attitude and practice questionnaire, respectively.

Demographic characteristics of the patients were also filled in the questionnaire. The patients were scored for their knowledge, attitude and practices based on their answers. The answers to 19 knowledge questions were scored as 1 for correct answers and 0 for incorrect answers (range from 0–19). 10 attitude questions were scored as 5 for *strongly agree*, 4 for *agree*, 3 for *doubtful*, 2 for *disagree*, and 1 for *strongly disagrees* for favorable questions, and the scores were 5 for *strongly disagree*, 4 for *disagree*, 3 for *doubtful*, 2 for *agree*, and 1 for *strongly agree* for unfavorable questions (total attitude scores ranged from 10–50). The scores were categorized as rational scales in good (> 14), average (10–14) and poor (< 10) for knowledge levels, and good (> 30), average (25–30) and poor (< 25) for attitude levels [14].

10 practice scores was also computed by scoring healthy practices as 1 and unhealthy practices as zero. The computed practice scores were classified in three categories including poor practice (0-3), averagely good practice (4-6), and good practice (7-10).

Statistics: The data were analyzed using SPSS version 19. Group means were compared using independent t-test and analysis of variance (ANOVA) after controlling for variance *hemosedacity* and data distribution. Qualitative variables were analyzed by Chi square test to show variable association. P values below 0.05 were considered statistically different or associated. Metabolic characteristics of the cases including serum cholesterol, HDL-C, TG, HbA1C,

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LDL-C and FBS were compared between the groups with good, average and poor levels of knowledge, attitude and practice using ANOVA. The Scheffe post-hoc test was used to determine the between-group differences, if the ANOVA test results were significant.

Results

198 cases participated in the study; 66 cases were females. The age range of the participants was 22-80 years. Age and anthropometric characteristics of the participants are shown in Table 1.

Means, standard deviation and also undesired proportions of metabolic parameters are shown in table 3. Findings showed that majority of patients had undesirable FBS (55.1%), serum LDL-C (58.8%), serum HDL-C (66%) and serum triglycerides (54%). The findings in Table 4 report the knowledge, attitude and practice conditions of the participants. As shown, a majority of them had low or average scores in knowledge, attitude and practice but a minor proportion of patients had good knowledge on diabetic nutrition.

Table 1. Mean and standard deviation of age, weight, and height and body mass index in diabetic patients

	sex	N	Mean±SD	P value
Age	Female	66	45.8±14.1	0.26
	Male	132	43.6±12.2	
Weight	Female	66	69.05±9.7	0.0001
	Male	131	77.2±10.4	
Height	Female	61	162.8±7.1	0.0001
	Male	122	173.4±7.5	
BMI	Female	61	26.3±3.5	0.6
	Male	121	25.8±3.8	

Data did not show any significant differences between the males' and females' body mass index (BMI) and age but height and weight in males were higher than in females. Demographic findings of the subjects including occupational and educational statuses, as well as residential areas are reported in Table 2.

Table 2. Demographic findings of cases

		Male number (percent)	Female number (percent)	Total number (percent)
Residency	Rural	72(55.8)	32(50.8)	104(54.2)
	Urban	57(44.2)	31(49.2)	88(45.8)
Employment status	Employed	105(82)	8(12.3)	113(58.5)
	Unemployed	2(1.6)	20(30.8)	22(11.5)
	Self-employed	15(11.7)	25(38.5)	40(20.7)
	Retired	6(4.7)	12(18.4)	18(9.3)
Education level	Illiterate	40(30.3)	14(21.5)	54(27.4)
	Primary	27(20.4)	8(12.3)	35(17.8)
	Secondary	12(9.1)	12(18.5)	24(12.2)
	High school	24(18.2)	11(16.9)	35(17.8)
	Academic	29(22)	20(30.8)	49(24.8)

Findings on the relationship between metabolic indices and nutritional knowledge showed that the serum HbA1C concentrations of diabetics with poor knowledge are significantly higher than the diabetics with good and average knowledge (p=0.003; Table 5). In the group with poor knowledge, FBS is also higher than in the other two groups (diabetics with average and good knowledge); however, the difference was not statistically significant (p>0.05). Table 6 shows the findings on the relationship between the patients' attitude and their metabolic parameters. There is an inverse association between patients' serum triglycerides and their attitude toward the diabetic nutrition; however, we could not find any association between other metabolic parameters and the patients' attitude. The results of the patients' nutritional practice did not show any significant relationship to metabolic parameters (Table 7).

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Table 3. The mean, standard deviation and frequency of desired and undesired metabolic indices measured in diabetic patients

Serum indices	Mean±SD	Optimal controlled Number (percent)	Poor controlled Number (percent)
Fasting Blood Glucos	150.8±83.9	87(43.9)	109(55.1)
HbA1C	6.9±2.2	116(58.9)	81(41.1)
HDL-C	42±6.6	66(34)	128(66)
LDL-C	109.1±37.3	80(41.2)	114(58.8)
Total cholesterol	186±48.6	131(66.8)	65(33.2)
Triglycerides	181±85	87(46)	102(54)

Table 4. Frequency of poor, average and good knowledge, attitude and practice of diabetic patients

	Poor		Average		Good	
	Number	Percent	Number	Percent	Number	Percent
Knowledge	11	5.6	157	79.3	30	15.1
Attitude	35	19.9	83	47.1	58	33
Practice	70	43.8	53	33.1	37	23.1

Table 5. Mean and standard deviations of patients metabolic indices compared based on their nutritional diabetic knowledge

Knowledge					95% Confidence Interval for Mean		F	P value
		Number	Mean	Std. Deviation	Lower Bound	Upper Bound		
Age	Poor	11	44.82	14.8	34.84	54.80	0.39	0.672
	Average	157	43.98	12.4	42.02	45.94		
	Good	30	46.27	14.9	40.69	51.84		
	Total	198	44.37	12.9	42.56	46.18		
FBS	Poor	11	193.82	97.6	128.24	259.40	2.9	0.054
	Average	155	143.76	80.٣	131.02	156.50		
	Good	30	171.60	91.9	137.25	205.95		
	Total	196	150.83	83.9	139.00	162.66		
HbA1C	Poor	11	8.7*	3.2	6.5	10.٩	5.92	0.003
	Average	156	6.7**	2.0	6.١	8.3		
	Good	30	7.5*	2.6	5.6	11.8		
	Total	197	6.9	2.2	6.5	8.5		
Cholesterol	Poor	11	180.73	51.43	146.17	215.28	0.14	0.86
	Average	157	193.78	88.20	179.87	207.68		
	Good	30	190.67	45.14	173.81	207.53		
	Total	198	192.58	81.27	181.19	203.97		
LDL-C	Poor	11	105.00	42.06	76.74	133.26	0.45	0.64
	Average	156	111.82	42.54	105.09	118.55		
	Good	30	104.77	39.2٦	90.11	119.43		
	Total	197	110.37	41.9٣	104.47	116.26		
HDL-C	Poor	11	43.73	8.18	38.23	49.23	0.01	0.99
	Average	156	44.29	20.2٢	41.09	47.49		
	Good	29	43.83	6.07	41.52	46.14		
	Total	196	44.19	18.2٧	41.62	46.76		
triglycerides	Poor	11	182.36	123.72	99.2٥	265.48	0.24	0.79
	Average	156	190.19	96.47	174.93	205.45		
	Good	29	202.55	104.68	162.73	242.37		
	Total	196	191.58	98.89	177.6٥	205.51		

*,** Different marks show different groups, *Scheffe post hoc test*

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Table 6. Mean and standard deviations of patients metabolic indices compared based on their nutritional diabetic attitude

					95% Confidence Interval for Mean		F	P value
		N	Mean	Std. Deviation	Lower Bound	Upper Bound		
Age	Poor	35	44.74	12.040	40.61	48.88	0.41	0.67
	Average	83	44.36	13.626	41.39	47.34		
	Good	58	42.62	12.578	39.31	45.93		
	Total	176	43.86	12.941	41.94	45.79		
FBS	Poor	35	151.57	113.204	112.68	190.46	0.12	0.88
	Average	82	155.89	76.276	139.13	172.65		
	Good	57	148.46	80.562	127.08	169.83		
	Total	174	152.59	85.759	139.75	165.42		
HbA1C	Poor	35	6.98	3.19	5.88	8.07	0.05	0.95
	Average	82	7.92	9.68	5.79	10.05		
	Good	58	7.64	6.13	6.02	9.25		
	Total	175	7.64	7.62	6.50	8.77		
Cholesterol	Poor	35	198.03	47.14	181.83	214.22	1.7	0.17
	Average	83	202.11	112.32	177.58	226.64		
	Good	58	180.31	47.09	167.93	192.69		
	Total	176	194.11	84.63	181.52	206.70		
LDL	Poor	35	120.60	38.95	107.22	133.98	1.87	0.15
	Average	83	110.47	44.22	100.81	120.13		
	Good	57	109.54	41.46	98.54	120.55		
	Total	175	112.19	42.30	105.88	118.51		
HDL	Poor	35	41.71	6.40	39.51	43.91	0.4	0.66
	Average	83	42.53	6.77	41.05	44.01		
	Good	56	45.11	17.01	40.55	49.66		
	Total	174	43.20	11.12	41.53	44.86		
Triglycerides	Poor	35	200.6*	95.54	16.51	256.2	5.2	0.006
	Average	83	192.5*	83.43	9.64	221.01		
	Good	56	151.8**	69.52	9.84	189.47		
	Total	174	180.9	83.41	6.37	207.12		

*,** Different marks show different groups, *Scheffe post hoc test*

Table 7. Mean and standard deviations of patients metabolic indices compared based on their nutritional diabetic practice

					95% Confidence Interval for Mean		F	P value
		N	Mean	Std. Deviation	Lower Bound	Upper Bound		
Age	Poor	70	43.9	12.1	41.1	46.8	0.99	0.37
	Average	53	46.2	14.9	42.1	50.3		
	Good	37	42.3	12.5	38.2	46.5		
	Total	160	44.3	13.2	42.3	46.4		
FBS	Poor	69	136.7	74.8	118.7	154.7	1.2	0.30
	Average	52	159.4	92.5	133.6	185.2		
	Good	37	148.3	68.9	125.3	171.3		
	Total	158	146.9	79.9	134.3	159.5		
Glycosylated hemoglobin	Poor	69	6.7	2.3	6.1	7.2	0.13	0.87
	Average	53	8.3	12.0	5.02	11.6		
	Good	37	6.9	1.8	6.3	7.5		
	Total	159	7.3	7.2	6.2	8.4		
Cholesterol	Poor	70	195.8	116.5	168.0	223.6	0.67	0.5
	Average	53	195.6	62.4	178.4	212.8		
	Good	37	192.4	47.5	176.5	208.2		
	Total	160	194.9	87.6	181.2	208.6		
LDL	Poor	70	113.0	41.5	103.1	122.9	1.5	0.22
	Average	52	106.8	44.9	94.2	119.3		
	Good	37	116.5	38.8	103.5	129.4		
	Total	159	111.8	42.0	105.2	118.4		
HDL	Poor	70	41.9	6.2	40.4	43.4	2.05	0.13
	Average	52	46.١	17.5	41.2	50.9		
	Good	37	44.٣	6.7	42.0	46.5		
	Total	159	43.8	11.4	42.0	45.6		
Triglycerides	Poor	70	192.4	105.7	167.1	217.6	0.45	0.64
	Average	53	193.5	88.8	169.0	218.0		
	Good	36	171.9	77.3	145.7	198.1		
	Total	159	188.1	94.2	173.3	202.8		

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Discussion

The research findings showed that few patients are well in diabetic nutritional knowledge, attitude and practice. Just 15 % of the patients were in good conditions of diabetes nutrition knowledge. This result on knowledge is in accordance with the findings of studies carried out in other parts of Iran (12, 13, 17) and other countries (5, 11, 18-23). Niroomand et al reported high levels of patients' knowledge, attitude, and practice among Iranian diabetics in Alborz Province (10). Shahrakivahed et al. found that 90 % of Iranian diabetics were not informed about diabetic nutrition (12). It appears that lack of nutritional knowledge, incorrect attitudes toward nutrition and also incorrect dietetic practices in diabetic patients are a common health problem in many countries including Iran (12, 13), India (18), Bangladesh (22), Mongolia (23), United Arab Emirates (5, 24), Saudi Arabia (25) and Nepal (26). In many countries, the diabetic education programs are implemented to improve diabetic knowledge, attitude and practices to reduce diabetic complications and costs. However, increasing the knowledge by itself may not be necessarily effective in promoting diabetic practices and management outcomes as shown in some studies (5, 15, 16, 27-29).

The study findings revealed that improving in knowledge is significantly associated with better metabolic control of FBG and glycosylated hemoglobin. In addition, better attitude was significantly associated with better serum triglyceride. However, analysis of knowledge, attitude and practice scores did not result in any significant relationship with other measured metabolic factors, including serum cholesterol, LDL-C and HDL-C. The diabetes education is a part of the diabetes prevention and control program of the Islamic Republic of Iran; in this program, the presence of a full time diabetes nurse and a part time nutritionist is anticipated to educate the diabetics (16). The goal of this diabetes control program is to maintain the fasting blood glucose between 60-90 mg/dl, cholesterol between 200-240 mg/dl, triglyceride 150-200 mg/dl, and LDL-C 100-130 mg/dl. Based on the cut-off points (14) 55.1, 41.1, 66, 58.8, 33.2, and 54% of the assessed patients had an undesirable serum FBS, HbA1C, HDL-C, LDL-C, total cholesterol and triglycerides, respectively, showing that a significant proportion of patients were not able to control their metabolic indices. Al-Maskari et al. in a study on the diabetic patients in the United Arab Emirates reported a 57% proportion poor glycemic control (HbA1C ≥8%). Yousefzadeh et al. found that 74% of women and 68.4% of men with diabetes diagnosis in Kerman Coronary Artery Disease Risk Study (KERCADRS) had serum glycosylated hemoglobin (HbA1C) higher than 7% (14). Also other studies reported higher prevalence of uncontrolled diabetes based on the HbA1C index in Iran (30) and other countries (31-33). Better condition in diabetic control in our study may be because of the effect of diabetes prevention and control program that is in progress from 1996 and the development of health centers besides employing more educated health personnel (16). However, a significant proportion of patients are yet at suboptimal conditions in terms of nutrition knowledge, attitude and practices.

Briefly, our findings suggest that in spite of diabetes prevention and control program of the Islamic Republic of Iran, nutrition knowledge, attitude and practice and also metabolic control of diabetics in Boirahmad are not satisfying yet and need to be promoted and be corrected by carrying out new interventions. More studies are required to determine the factors affecting metabolic controls in diabetics.

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