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The Relationship between Literacy Level and Coronary Risk Factors in Diabetic Patients

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Abstract

Background: Diabetes and illiteracy are common problems in developing countries. In studies on diabetes and cardiac risk factors, literacy level, especially illiteracy, is not adequately addressed. Coronary heart disease (CHD) is a major complication of diabetes and the leading cause of premature death. The purpose of the study was to examine the relationship between literacy level and coronary risk factors in Non-Insulin Dependent Diabetes Mellitus (NIDDM) patients.

Methods: A cross-sectional study was conducted in an urban federally funded diabetic's clinic in Bandar Abbas, Iran. The sample consisted of 256 diabetic patients who were classified into three groups: Illiterates, low-literates and literates. The coronary risk factors were delimited to HbA1C, LDL, HDL, total cholesterol (TC), Triglyceride (TG), Body Mass Index (BMI), and blood pressure.

Results: 67.5% of the patients were female, 42.1% illiterates, and 70% were overweight. The measures of TC and BMI were higher among females than males. Differences among the literacy levels based on LDL, TC, HDL, and TG were statistically significant.

Conclusion: According to our findings, literacy level does not have a role in glycemic control, but may affect LDL, HDL, TC and TG.

Keywords: Coronary risk factors; Diabetes; Glycated hemoglobin (HbA1C); Literacy

Introduction

Cardiovascular Disease (CVD) is the most common cause of mortality in urban industrial and developing countries [1]. Nearly 42.2% daily deaths in Iran were due to CVD [2]. It is reported that CVD can be caused by diabetes and is a leading cause of premature death among people with Non-Insulin Dependent Diabetes Mellitus (NIDDM) [1]. In addition, NIDDM coexists with other conditions like obesity, dyslipidemia, atherosclerotic vascular disease, and hypertension [3]. The risk of CVD in people with NIDDM is between two and five times higher than it is for non-diabetic patients [4]. The major clinical objective in the management of NIDDM is to control hyperglycemia, and the long-term objective is to prevent micro vascular and macro vascular complications [5].

Dyslipidemia is an important risk factor for the development of CVD. Patients with diabetes are also found to have higher lipid values and a greater incidence of obesity and hypertension than patients without diabetes [6]. The incidence of CVD can be reduced by control of blood pressure (BP), lipid modification, and glycemic control [5]. Diabetes and illiteracy are serious problems in developing countries. In Iran, 2% of the population suffers from diabetes [7] and illiteracy level is estimated to be around 23% [2].

In studies of diabetes and cardiac risk factors, literacy/illiteracy is ignored. Literacy is defined as a functional and context-specific skill that includes oral skills (listening and speaking) and print-based skills (reading and writing) [8]. Studying the relationship between literacy and health is important to 1) better understand the true etiology of poor health outcomes; 2) identify a potential clinical marker of patients at risk for poor outcomes; and 3) develop effective interventions [9].

Improved glycemic control (HbA1C <7%) reduces the risk of diabetic complications and mortality [10]. A study demonstrated that poor glycemic control was prevalent among patients with low literacy [11]. However, another study reported Diabetes-related knowledge is often not strongly associated with glycemic control [12].

To examine the relationship between literacy level and coronary risk factors in NIDDM patients, we measured HbA1C, lipid profile, Body Mass Index (BMI), and blood pressure. Results from this study can help future interventions to improve diabetes outcomes among patients with different literacy levels.

Methods

A cross-sectional study was conducted in an urban federally-funded diabetics clinic with 1400 registered diabetes patients in Bandar Abbas, a port city in south of Iran. The sample consisted of 256 NIDDM patients who had been diagnosed as being diabetic for at least one year prior to the conduct of the study by an internist. The subjects voluntarily agreed to participate in the study.

Based on the literacy level, patients were classified into three groups: 1) Illiterates, 2) low-literates (less than 7 years of schooling), and 3) literates (more than 7 years of schooling) [9,13]. The coronary risk factors were delimited to Glycated Hemoglobin (HbA1C), LDL, HDL, total cholesterol (TC), Triglyceride (TG), BMI, and blood pressure.

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Metabolic control was assessed by measuring HbA1C. To do that, we used colorimetric method. According to this method, in diabetic patients, HbA1C <7 indicates good control, 7- 9 is fair control, and >9 represents bad (poor) control [14]. Total HDL, TG, and HbA1C were measured in fasting conditions by standard enzymatic methods. LDL was calculated indirectly according to Friedwald (TC– HDL– TG/5), excluding patients with TG >4.5 mmol/L (400 mg/dL) because the formula is not reliable in the presence of marked hyper-triglyceridemia.

Systolic and Diastolic BP was the mean of two measurements in sitting position by mercury sphygmomanometer after at least 20 minutes of rest, using the appropriate cuff size.

Body weight was measured to the nearest 0.1 kg on a scale with attached height measure. BMI was calculated as weight/height^2 (kg/m^2) and obesity was defined as BMI ≥30 kg/m^2. Smokers were categorized as either current smokers, independent of the number of cigarettes per day, never smokers, or previous smokers (quitting tobacco for at least 6 months prior to the study) [15].

Analysis of data included one-way analysis of variance, Tukey's HSD post hoc procedure, and bivariate associations. The level of significance was set, a priori, at 0.05. The Statistical Package for the Social Sciences (SPSS) was employed for the purpose of data entry entry, manipulation, and analysis.

Results

The majority of the subjects (67.5%) were female and married (70%). The mean age was 49.15 ± 9.5 years old, ranging from 27 to 72. Nearly 70% of the patients were overweight with BMI of more than 25. The duration of diabetes ranged from 1 to 30 years (6.33 ± 5.12). The majority (81.5%) used oral anti-diabetics and diet (OAD) to control the disease, followed by 13.7% who used insulin and diet, and 4.8% who only relied on diet. Analysis of the data showed that with the exception of TC and BMI in which females significantly scored higher than did males, none of the gender differences was statistically significant. Results are summarized in Table 1.

Variables	Overall, N=256	Males N=83 (32.5%)	Females N=173 (67.5%)	p
Age (years)	49.15 ± 9.6	51 ± 9.7	48 ± 9.48	NS
Elders (≥65 years) (%)	7.9	9.8	7.2	NS
Active smokers (%)	14.4	14.6	14.3	NS
Systolic BP (mmHg)	129 ± 21	127 ± 21*	132 ± 21	NS
Diastolic BP (mmHg)	85 ± 12	85 ± 13 (60-140)	85 ± 11	NS
Total cholesterol (mg/dL)	207 ± 43	191 ± 36	215 ± 44	<0.05
Hyper- cholesterolemia(%) High risk (chol. ≥ 253 mg/dl)	24.1	7.7	32.5	<0.05
LDL cholesterol (mg/dL)	124 ± 37	119 ± 40	127 ± 35	NS
High LDL cholesterol (%)	15.4	12.1	17.3	NS
HDL cholesterol (mg/dl)	44 ± 10.3	42 ± 10.7	46 ± 9.9	NS
Low-HDL cholesterol (%) (low HDL chol ≤ 35 mg/dl)	30.1	51.5	18.3	NS
Serum triglycerides (mg/dL)	200 ± 94.8 (58-493)	186 ± 90 (58-441)	208 ± 96 (90-493)	NS
High triglycerides (%)	37.4	33.3	39.5	NS
BMI (kg/m^2)	27.9 ± 5.4	25.7 ± 3.5	29.1 ± 5.88	<0.05
Obesity (%)	34.7	12.5	45.7	NS
HbA1c	8.37± 2.14 (4.2-17.6)	8.16 ± 1.93 (4.6-13)	8.4 ± 2.25 (4.2-17.6)	NS

Table 1: A Profile of the subjects.

Behavior	Total patients	Illiterate	Low literate
Smoking	N (%)	N (%)	N (%)
No	214 (83.5)	88 (81.4)	84 (84)
Yes	42 (16.5)	20 (18.6)	16 (16)
Exercise			
Always	138 (53.9)	53 (49)	53 (53)
Seldom	30 (11.71)	12 (11.11)	10 (10)
Never	88 (34.39)	43 (39.89)	37 (37)
Foot care			
Yes	94 (36.71)	27 (25)	44 (44)
No	162 (63.29)	81 (75)	56 (56)
Weight monitoring			
No	137 (53.35)	78 (72.2)	49 (49)
Yes	119 (46.65)	30 (27.8)	51 (51)
Compliance with dietary regimen			
Always	137 (53.35)	55 (50.92)	56 (56)
Seldom	83 (32.42)	34 (31.48)	33 (33)
Never	36 (14.23)	19 (17.61)	11 (11)
Adherence to treatment regimen			
Always	203 (79.29)	84 (77.77)	85 (85)
Often	31(12.1)	13 (12.03)	10 (10)
Never	22 (8.61)	11 (10.2)	5 (5)

Table 2: A Cross-tabulation of literacy level by behaviors.

The analysis of the literacy data showed that 42.1% of the subjects were illiterate, followed by 39% low literates, and 19% literate. Chi-square Test of Independence revealed that group differences on the basis of foot caring and weight monitoring were statistically significant and showed that the illiterates used both less frequently than did the other two groups. Results are summarized in Table 2. Additionally, group differences on the basis of LDL, TC, HDL, and TG were statistically significant; differences due to HbA1C, BMI, and BP were not statistically significant.

Pearson's product moment correlation coefficient was employed to examine the direction and magnitude of the bivariate associations among the study's variables. As can be seen in Table 3, the majority of the associations were not statistically significant.

On the basis of the National Cholesterol Education Program Adult Treatment Panel III criteria, the study participants were classified for Dyslipidemia [16]. The National Institute of Diabetes and Digestive and Kidney Diseases recommends as the best cholesterol to HDL ratio is 3.5:1 and below 5:1 as the goal. In our study, we found that 6.5% and 62% of the participants achieved these ratios. On the basis of the American Heart Association's classification, 22.2% of the illiterates in our study had over borderline LDL and 35.4% had high TC. Approximately, 50% of the literates had low HDL and 44.4% of low literates had high TG. Results are summarized in Table 4.

Discussion

The guidelines for management of Diabetes Mellitus (DM) recommend intensive control of blood sugar in an attempt to reach the target of less than 7% HbA1C, which is associated with reduced morbidity and mortality [17,18]. In our study, only 30% of the patients reached this target, which is alarming. On the other hand, we did not find any relationship between literacy level and glycemic control, which is supported by other studies [12,19,20] while Jahanlou, et al. [13] and Fisher [21] observed a moderate inverse relationship. The difference could be due to inclusion of illiterate patients in our study, while theirs was delimited to low literate and literate patients. Like DeWalt [22]

		Age	BMI	Duration of diabetes	HbA1c	LDL	HDL	Chol	TG
Age	Pearson correlation	1							
	Sig. (2-tailed)								
BMI	Pearson correlation	-0.124	1						
	Sig. (2-tailed)	0.177							
Duration of diabetes	Pearson correlation	.293**	-0.016	1					
	Sig. (2-tailed)	0.001	0.864						
HbA1c	Pearson correlation	-0.059	-.253(**)	0.082	1				
	Sig. (2-tailed)	0.539	0.008	0.391					
LDL	Pearson correlation	0.084	-0.072	0.063	0.041	1			
	Sig. (2-tailed)	0.429	0.503	0.555	0.705				
HDL	Pearson correlation	-0.169	0.045	0.102	-0.037	0.019	1		
	Sig. (2-tailed)	0.105	0.675	0.331	0.732	0.856			
Chol	Pearson correlation	-0.02	0.147	0.042	0.069	.643(**)	.404(**)	1	
	Sig. (2-tailed)	0.831	0.121	0.656	0.478	0	0		
TG	Pearson correlation	0.082	0.129	0.057	0.05	0.021	-0.056	.377(**)	1

Table 3: Correlation matrix.

Measure fasting lipoproteins in mg/dL			Total	Patients	Illiterate low	Literate
	<200	Desirable	43.1%	43.8	44.7	38.1
	200-239	Borderline high	32.8%	20.8	34	57.1
TC						
	≥240	High	24.1%	35.4	21.3	4.8
	<100	Optimal	24.2	13.9	33.3	26.3
	100-129	Near optimal/ above optimal	37.4	44.4	33.3	31.6
LDL						
	130-159	Borderline high	23.1	19.4	25	26.3
	160-189	High	11	13.9	5.6	15.8
	≥190	Very high	4.4	8.3	2.8	0
	<40	Low	30.1%	19.4	22.4	50
	≥60	High	7.5%	2.8	13.5	5
HDL						
	<150	Desirable	35.7%	33.3	31.1	50
	150-199	Borderline high	27%	31.3	24.4	22.7
TG						
	200-499	High	37.4%	35.4	44.4	27.3
	≥500	Very high	0	0	0	0

TC: Total Cholesterol; LDL: Low-Density Lipoprotein; HDL: High-Density Lipoprotein;
TG: Triglyceride

Table 4: Subjects' Classification of Dyslipidemia According to National Cholesterol Education Program Adult Treatment Panel III, n=256.

study, we did not find any statistically significant differences among literacy levels on the basis of literacy level [15].

It is reported that CHD is the leading cause of mortality in NIDDM patients [3]. Several factors contribute to the increased propensity toward premature atherosclerosis in diabetes. Alterations in serum lipoprotein pattern are one of them. Abnormalities in serum lipids, particularly in LDL, must be carefully evaluated to establish the individual CHD risk profile. In our study, only 13.9% of the patients had achieved an optimal level of LDL. On the basis of the National Cholesterol Education Program [23] (NCEP) standards, in the current study, only 2.2% of patients had LDL less than 70 mg/dl and 35.7% of patients had TG level less than 150 mg/dl. The NCEP Adult Treatment Panel recommends that management of lipid abnormalities be based primarily on LDL level and this recommendation was endorsed by the American Diabetes Association [24].

Based on the classification criteria proposed by the American Heart Association [25], we found that 22.2% of illiterate patients had over the borderline LDL and 35.4% had high TC; 50% of literates had low HDL and 44.4% of low literates had high TG. According to the CSIRO classification [21], having a cholesterol level greater than 6.5 mmol/L (253 mg/dL), HDL cholesterol level less than 0.9 mmol/L (35 mg/dL), and TG level greater than 2.3 mmol/L (204 mg/dL) can increase the risk of CHD. None of the subjects in our study met these criteria.

A number of recent studies on individuals with diabetes indicate that in addition to maintaining optimal glucose levels, aggressive CHD risk factor control is critical for reducing the risk of CHD [26]. In our study, illiterates had high levels of total cholesterol and LDL without maintaining optimal glucose level, indicating that such patients are in high risk of CHD. On the other hand, 50% of the literates had low HDL without optimal glucose level and 44.4% of the low literates had high TG level without optimal glucose level. These findings suggest that the perception of "glycemic control" and "hyperglycemia reduction" is low in patients, especially among the illiterates. Awareness of CHD risk factors has been positively related to the desire to make risk-reducing behavioral changes [27]. The perceptions of personal risk for a disease may be an important factor in developing preventive health behaviors [28] and evidence supporting risk perception as the first step toward desired health behavior [29].

According to our findings, literacy level does not have a role in glycemic control, but may affect LDL, HDL, TC and TG. Due to cross-sectional nature of our study, it is possible that some of the variables we examined would be related to longitudinal outcomes such as changes in HbA1C.

Suggestions for Further Research

Future studies may evaluate other treatment variables that may help explain the pathways toward good diabetes outcomes. Further research is needed to develop a literacy sensitive instrument that takes into consideration the knowledge variations and the specific needs of the diabetics.

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