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ORIGINAL RESEARCH

Comparison of self-care in non-cardiac diabetic patients

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Fatemeh Asghari[1]
Monir Nobahar[1–3]

[1]Faculty of Nursing and Midwifery, Semnan University of Medical Sciences, Semnan, Iran; [2]Nursing Care Research Center, Faculty of Nursing and Midwifery, Semnan University of Medical Sciences, Semnan, Iran; [3]Social Determinants of Health Research Center, Semnan University of Medical Sciences, Semnan, Iran

Background: In general, the majority of diabetic patients suffering from a lack of capability in controlling different aspects of self-care have likely been prone to cardiovascular disease. To reduce the economic burden in societies and the rate of death on one hand, and improve life expectancy, on the other hand, it seems necessary to emphasize self-care training in diabetic patients. The purpose of this study was to determine comparison of self-care in cardiac and non-cardiac diabetic patients.

Methods: This descriptive-analytic study was carried out with 136 diabetic participants selected using random sampling and divided into two groups of 68 non-cardiac diabetic patients. Data were collected using a demographic and diabetic patient's self-management questionnaire (DSMQ). For the analysis of the data, SPSS16 was employed to check the significance test at the level of $P<0.05$.

Results: In this study, twenty-eight (41.2%) and forty (58.8%) of the participants in each group were male and female, respectively. Their ages spanned from (61.35±13.34) in non-cardiac diabetic group to (65.94±8.74) in cardiac diabetic participants. There were significant differences between two groups, specifically in patients with cardiac diabetic disease in different aspects, for instance, including glucose monitoring (F=4.977, $P=0.027$, $\eta^2=0.036$), diet control (F=9.125, $P=0.003$, $\eta^2=0.064$), physical activity (F=22.954, $P=0.0001$, $\eta^2=0.146$) and health care awareness (F=31.366, $P=0.0001$, $\eta^2=0.19$).

Conclusion: According to DSMQ questionnaire in the present study, glucose monitoring, diet control, physical activity, and health care awareness in diabetic patients with heart disease were significantly reported to have been better than the other group with no cardiac problem. Due to insufficient self-care in diabetic patients and some consequences such as poor health, heart disease as one of the complications of diabetes, hospital re-admission and heavy costs, the therapeutic team should be alerted to self-care training.

Keywords: type II diabetes, self-care, heart disease

Introduction

Type I diabetes is caused by a loss of physical or functional β-cell mass, due to an autoimmune process in most cases.[1] type II diabetes is a kind of pathophysiologic abnormalities in three stages of insulin secretion, peripheral insulin resistance, and excessive glucose production by liver cells. Consequently, it has tended to apparent diabetes with fasting hyperglycemia and ultimate failure in pancreatic beta cells,[2] considered as an epidemic of the 21 century and[3] as an effective role in the quality of life, occupation, and social relationships.[4]

The total number of diabetic patients is likely to reach 592 million by 2035.[5] attributed to the lack of awareness of many people as to diabetes in Iran, therefore, the number of diabetic patients is estimated to be more than 7 million cases.[6] With

Correspondence: Monir Nobahar
Nursing Care Research Center, Faculty of Nursing and Midwifery, Semnan University of Medical Sciences, Semnan, Iran
Tel +98 2 333 654 190
Fax +98 2 333 654 209
Email Nobahar43@Semums.ac.ir

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155,000 annual increase of new diabetic cases in Iran[7] and a high risk of cardiovascular disease in this group,[8] the mortality rate in diabetic patients is reported to be two to four times greater than in non-diabetic people.[9] According to the definition of the American Heart Association (AHA), cardiovascular disorders consist of myocardial infarction, congenital and cardiac rhythm, secondary cardiac arrhythmias, heart failure (HF), heart valve and Peripheral arteries diseases.[10] National Health and Nutrition Examination Survey's Studies (NHANES) show that the American Diabetes Association's recommendation for prevention of coronary artery disease and other complications stemming from diabetes have been fully considered in just 5–12 percent of patients with type 2 diabetes.[11]

Although the function of care in diabetic patients is to maintain a good level of blood glucose and reduce complications,[12] however, some factors including personal and systemic barriers do not make diabetic patients able to control their blood glucose. Given the fact that[13] overweight and unhealthy lifestyle would pave the way for cardiovascular disorders and diabetes[14] as well as the global trend of diabetes, the aftermath consequences indeed are death, disease burden, lower life expectancy, higher costs and weaker control management over diabetes in low and middle-income countries.[5] As a key to an individual's health, self-care in diabetes[15] improves self-efficacy[16] and quality of life.[17] Further, self-care as a combination of motivational and problem-solving interventions[18] reduces the incidence of diabetes in high-risk individuals and improves cardiovascular symptoms in diabetics.[19]

Undoubtedly, diabetic patients with little awareness as to self-care are more likely to be exposed to cardiovascular disorders.[11] To lessen the economic burden in societies and the rate of death and ameliorate life expectancy further,[3] the importance of self-care in diabetes should be the core of any therapeutic sessions. In other words, self-care as the main foundation for the treatment of the disease is one of the nursing research priorities.[20] According to recent studies, the most important reason for mortality in diabetic patients is the lack of attention to self-care.[21,22] conducted studies by the World Health Organization (WHO) demonstrate that diabetic patients' satisfaction with prescribed treatments, for example, adherence to diet is about 50% in developing countries and less than this in developed countries.[23]

Despite the backbone of studies, in Iran, there are three million patients suffering from type II diabetes, as it is in different countries around the world.[24] Regarding the patient's awareness of self-care, the huge costs required for treatment of diabetes as well as its complications for the public health system,[3] the purpose of this study was to compare the adherence of self-care behaviors in non-cardiac diabetics patients.

Materials and methods

This descriptive-analytic study was conducted on 136 diabetic patients addmitted in Kosar hospital located in Semnan, Iran. The participants were randomly divided into two groups of 68 later categorized as cardiac diabetic and non-cardiac diabetic patients.

The main criteria for selection of this sample:

- They should be over 20.
- They had been diagnosed with diabetes for at least six months.
- There should be no sign of brain diseases such as dementia, delirium, learning disabilities, speech and hearing disorders.
- They should not be addicted to any psychotic drugs.

Data collection and analysis

In the present study, 28 (41/2%) and 40 (58/8%) of the participants in each group were male and female, respectively. The age average ranged from (65.94±8.74) in the diabetic group with heart disease to (61.35±13.34) in the diabetic group without heart disease. The level of education of non-cardiac diabetic group has been reported to be a diploma, 35 (51.5%) diabetics suffering from heart disease 29 (42.6%) diabetics with no sign of heart disease. Other factors including income average were mainstream among 52 (75.6%) cardiac diabetics and 44 (64.7%) non-cardiac diabetics. Approximately, some participants including 36(52.9%) diabetics and 48 (70.6%) cardiac diabetics had to inject insulin. Further, significant differences were observed between two groups at the level of education, salary and insulin injection ($P<0.05$), though there were no significant differences in their ages and genders ($P>0.05$). (See Table1)

Data were collected using a demographic questionnaire containing information such as age, sex, level of literacy, monthly income and history of heart disease. Moreover, a self-care standard questionnaire in diabetic patients (DSMQ) was administered. This questionnaire is a relatively new psychometric instrument for self-care

Table 1 Diabetic patient characteristics (with and without heart disease)

Group		With heart disease	Without heart disease	Test
Variable	**Label**	**Frequency(Percent)**	**Frequency(Percent)**	
Gender	Male Female	28(41.2) 40(58.8)	28(41.2) 40(58.8)	χ^2=0, *P*=1>0.05
Education	High school Diploma Bachelor's Degree Master's Degree	35(51.5) 13(19.1) 15(22.1) 5(7.4)	29(42.6) 19(27.9) 17(25) 3(4.4)	χ^2=11.27, *P*=0.016<0.05
Salary	Average Good Very good	52(75.6) 16(23.5) 0	44(64.7) 16(23.5) 8(11.8)	χ^2=8.667, *P*=0.013<0.05
Insulin need	Yes No	36(52.9) 32(47.1)	48(70.6) 20(29.4)	χ^2=4.484, *P*=0.034<0.05
Age (years)	Mean ± SD	65.94±8.745	61.35±13.343	T=2.372, *P*=0.09>0.05

Notes: For analysis of the data, independent sample t-test was used and the result displayed that while significant differences were observed in different aspects including education, salary and need to insulin injection between 2 groups of participant ($P<0.05$), there were no such significant variations between them concerning their age and gender ($P>0.05$).

assessment of diabetes, which was introduced in 2013 and designed to pose important questions including, for instance, diet, medicine, blood glucose monitoring and contact with health care professionals, with a particular focus on blood glucose control activities. The questionnaire consisted of 16 questions in five different aspects of self-care in diabetes (four in diet, two in drug adherence, three in the blood glucose monitoring as well as three in physical activity, and three in the physician's meeting). It was described as a behavioral respondent's personality. Premised on the Likert Scale, each item is scored from 0 (lowest score) to 3 (highest scores). The reliability and validity of this questionnaire concerning the evaluation of self-care in diabetic patients were presented in the Schmitt study.[25]

For the present study, upon the permission of the Semnan University Medical Sciences' Ethics Committee, this research has been carried out. To do so, the first researcher introduced herself to the research units and expressed the purpose of this study as well as obtained written consent from the participants. The questionnaires were filled out by diabetic patients admitted to the Kosar hospital during January and February 2018.

Analysis of the data was conducted using SPSS 24 to run ANOVA test, chi-square, independent sample *t*-test and Exploratory Factor Analysis (EFA (with the level of Significance considered at $P<0.05$. For the further assessment of the items, Factor analysis (FA) run was consistent with the Tabachnick and Fidell.[26] For a specific theory and related variables in the analysis, factor analysis as one of the best statistical analyses could explain the underlying structure. With the goal of reducing the number of items into a smaller set of new composite dimensions, factor analysis was employed.[27] Generally speaking, for the set of coherent subsets to determine the variable of interest that are relatively independent of each other, exploratory factor analysis (EFA) was employed. The purpose of EFA was to explain the structure underlying the data and provide information to the researchers about the number of possible factors that best would represent the data.[28] Therefore, EFA was used to examine the items and factors applied in the studies.

Exploratory factor analysis (EFA)

In the present study, to explore the structure of the measurement items compared to the variables offered in the theoretical framework, exploratory factor analysis (EFA) was applied as a means for factor extraction and PCA for the validity of the scale. The method of the orthogonal Varimax rotational was chosen for the extraction. The Eigenvalues greater than one accounted for the latent root criterion and solution about 60% or more cumulative variance that also explained the criterion of variance percentage.[28] As a communality, the total variance of an original variable shared with other variables was also determined.[28] For sampling adequacy and Bartlett's Test

of Sphericity, it is suggested to consider the Kaiser-Meyer-Olkin (KMO) test.[29] For EFA to make available parsimonious set of factors as suitable, the value of KMO which is greater than 0.6 indicate a statistically significant relationship between items.[26] Regarding the items stemming from the literature, EFA was run separately. Initially,[16] items related to all variables were examined that accounted for four theoretically defined constructs. The results revealed that the KMO value was greater than 0.6 and Bartlett's test was significant (P<0.001), therefore, the first assumptions for the EFA were met (See Table 2). Commonalities were shown by each item. All of the items including commonalities above 0.5 with their construct and the total variances were described each component. The number of factors with eigenvalue>1 was considered significant and the rest were disregarded 26 (See Table 3).

In Table 4 the eigenvalues associated with each linear component (factor) before and after extraction as well as after rotation have been listed. Before extraction, SPSS has identified 16 linear components within the data set. In the final part of the table (labeled Rotation Sums of Squared Loadings), the eigenvalues of the factors after rotation were illustrated. The rotation has the effect of optimizing the factor structure, and one consequence is that the relative importance of the four-factors was even. Finally, the rotated pattern matrix (Table 4) has shown four factor solutions. It is recommended that the absolute correlation between construct and its measuring item (ie, factor loading) should be higher than 0.7.[30] The results in the table of pattern matrix show that the minimum factor loadings were reported more than 0.7. (See Table 4).

Hypothesis testing

To investigate group differences in Self- care, a one-way between-groups multivariate analysis of variance was performed. Four dependent variables were used: Glucose Management, Diabetes Control, Physical Activity, and Health Care. The independent variable was the non-cardiac group of diabetics. Preliminary assumptions were checked: normality, linearity, univariate and multivariate outliers, homogeneity of variance and covariance matrices, and multicollinearity. The statistically significant difference was observed between diabetics suffering from non-cardiovascular problems on the combined dependent variables, F (4, 131) =22.941, P=0.001; Wilks' Lambda =0.588; partial eta squared (η^2)=0.412.

Results

The mean scores have provided us with the statistical analyses as follows:

1. The test of ANOVA has demonstrated the significant effect of glucose monitoring (F=4.977, P=0.027, η^2=0.036). Thus, the null hypothesis was

Table 2 Commonalities shared and initial assumptions of Exploratory Factor Analysis (EFA)

Item	Extraction	Kaiser-Meyer-Olkin (KMO)	Bartlett's test of sphericity	
			χ^2(df)	*P*-Value
Checking blood sugar levels with care and attention	0.781	0.874	1540.789(120)	0.001
Taking diabetes medication as prescribed	0.75			
Recording regularly blood sugar levels	0.755			
Not checking frequently blood sugar levels enough	0.724			
Forgetting to take/skip diabetes medication	0.788			
Choosing food to easily achieve optimal blood sugar	0.791			
Eating occasionally lots of sweets/high-carb foods	0.816			
Following diet specialist's recommendations	0.857			
Having sometimes real "food binges"	0.842			
Doing physical activity to achieve optimal sugar levels	0.824			
Avoiding physical activity, although good for diabetes	0.793			
Skipping planned physical activity	0.754			
Keeping recommended doctors' appointments	0.76			
Avoiding diabetes-related doctors' appointments	0.779			
Visiting medical practitioner(s) more often	0.808			
Lack of rich diabetes self-care	0.789			

Notes: 16 items related to the all variables were examined to contribute in 4 theoretically established constructs. The results revealed that the KMO value was greater than 0.6 and Bartlett's test was significant (P<0.001), which met the initial assumptions for the EFA.

Table 3 Eigenvalues and variance extracted by each component

Component	Initial eigenvalues			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.605	41.280	41.280	3.682	23.010	23.010
2	2.287	14.294	55.573	3.382	21.134	44.144
3	2.022	12.640	68.214	3.129	19.559	63.703
4	1.698	10.612	78.825	2.420	15.122	78.825
5	0.479	2.995	81.821			
6	0.417	2.605	84.426			
7	0.371	2.317	86.743			
8	0.341	2.132	88.876			
9	0.315	1.969	90.844			
10	0.264	1.648	92.493			
11	0.247	1.546	94.039			
12	0.230	1.436	95.475			
13	0.219	1.368	96.843			
14	0.182	1.140	97.984			
15	0.173	1.083	99.067			
16	0.149	0.933	100.000			

Extraction method: principal component analysis.

Notes: Commonalities enlightened by each item. All of the items allocated above 0.5 commonalities with their construct and explained the total variance described by each component. The number of factors that had given value >1 were just regarded as significant and the rest were eliminated.

rejected as it has buttressed the idea that diabetics with heart disease reported having higher levels of glucose monitoring (M=11.059, SD=3.536) compared to diabetics without heart disease (M=9.485, SD=4.618).

2. The test of ANOVA has demonstrated the significant effect for diet Control (F=9.125, P=0.003, η^2=0.064). The null hypothesis was rejected as it has supported that diabetics with heart disease had higher levels of diet Control (M=8.779, SD=3.42) than diabetics with no heart disease (M=6.971, SD=3.562).
3. Concerning the physical activities between two groups using ANOVA, the differences were statistically significant F=22.954, P=0.0001, η^2=0.146). Therefore, the null hypothesis was rejected; it was shown that diabetics with heart disease had slightly higher levels of physical Activity (M=10.147, SD=2.228) compared to diabetics with no cardiovascular problems (M=7.897, SD=3.168).
4. Finally, as the test of ANOVA demonstrated, health Care awareness was statistically significant F=31.366, P=0.0001, η^2=0.19). Hence, the null hypothesis was rejected and accounted for the higher levels of Health Care awareness in diabetics with heart disease (M =7.691, SD =1.469) than diabetics without heart disease (M=7.897, SD=2.19). (see Table 5)

Discussion

The purpose of the present study was to investigate the difference between non-cardiac diabetics patients in terms of the level of self-care. The management of diabetes is unique in the long-term care (LTC) setting.[31] conducted studies by the World Health Organization (WHO) explained diabetic patients' compliance rate with prescribed treatments, for example, adherence to the diet was reported to be about 50% in developed countries and less than this in developing countries.[23] National Health and Nutrition Examination Survey's Studies show that the American Diabetes Association's recommendation for prevention of coronary artery disease and other complications due to diabetes has been fully considered in merely 5–12 percent of patients suffering from type 2 diabetes.[11]

Regarding the lack of self-care in non-cardiac diabetics versus diabetics with heart disease, this piece of research has paved the way to find out the reasons underpinning of patients' sufficient lack of attention to self-care and its subsequent complications. According to the studies conducted by Forouhi (2014), the main risk factors for type 2 diabetes are age, obesity, family history, and physical inactivity.[5] Among these factors, obesity and physical inactivity, attributed to an individual's awareness about a healthy lifestyle, should be avoided. Further, the lifestyle has a significant role

Table 4 Factor structure matrix of loading variable

Item	Component			
	Glucose	Diet	Physical	Health
	Monitoring	Control	Activity	Care awareness
Checking blood sugar levels with care and attention	*0.848			
Taking diabetes medication as prescribed	*0.832			
Recording regularly blood sugar levels	*0.806			
Lack of checking blood sugar sufficiently and frequently	*0.798			
Missing diabetes medication	*0.789			
Choosing food to easily achieve optimal blood sugar		*0.823		
Eating occasionally lots of sweets/high-carb foods		*0.88		
Following diet specialist's recommendations		*0.887		
Having sometimes real "food binges"		*0.894		
Doing physical activity to achieve optimal sugar levels			*0.888	
Avoiding physical activity, although it is good for diabetes			*0.857	
Skipping planned physical activity			*0.825	
Diabetes self-care is poor			*0.793	
Avoiding diabetes-related doctors' appointments				*0.831
Visiting medical practitioner(s) more than often				*0.876
Keeping recommended doctors' appointments				*0.879
Extraction Method: Principal Component Analysis.				
Rotation Method: Varimax with Kaiser Normalization.				

Notes: The eigenvalues associated with each linear component (factor) before and after extraction as well as after rotation. The results in pattern matrix table show that the items with the minimum factor loadings above 0.7 were loaded on four factors. *Matrix of loading variable above 0.7.

Table 5 Result of ANOVA

Construct	Group	Mean	Std. deviation	N	F(*P*-Value)	Effect size(η^2)
Glucose monitoring	Diabetes with heart disease	11.059	3.536	68	4.977(0.027)	3.6%
	Diabetes without heart disease	9.485	4.618	68		
Diabetes control	Diabetes with heart disease	8.779	3.420	68	9.125(0.003)	6.4%
	Diabetes without heart disease	6.971	3.562	68		
Physical activity	Diabetes with heart disease	10.147	2.228	68	22.954(0.001)	14.6%
	Diabetes without heart disease	7.897	3.168	68		
Health-care awareness	Diabetes with heart disease	7.691	1.469	68	62.587(0.001)	31.8%
	Diabetes without heart disease	5.162	2.190	68		
Self-care	Diabetes with heart disease	37.676	6.858	68	31.366(0.001)	19%
	Diabetes without heart disease	29.515	9.869	68		

Notes: ANOVA for glucose monitoring was significant and supporting that diabetics with heart disease reported slightly higher levels of glucose monitoring (M=11.059, SD=3.536) than diabetics without heart diabetes (M=9.485, SD=4.618). for diet control was significant too and supporting that diabetics with heart disease reported slightly higher levels of diabetes control (M=8.779, SD=3.42) than diabetics without heart diabetes (M=6.971, SD=3.562). ANOVA for physical activity was significant and supporting that diabetics with heart disease reported slightly higher levels of physical activity (M=10.147, SD=2.228) than diabetics without heart diabetes (M =7.897, SD =3.168).as well as ANOVA for health-care awareness was significant and supporting that diabetics with heart disease reported slightly higher levels of health care awareness (M =7.691, SD =1.469) than diabetics without heart disease (M=7.897, SD=2.19). ANOVA for self-care was significant and supporting that diabetics with heart disease reported higher levels of self-care (M=37.67, SD=6.85) than diabetics without heart disease(M=29.51, SD=9.86).

in the development of the cardiovascular disorder.[14] Therefore, the awareness of diabetics about the importance of self-care behaviors could protect against its subsequent complications, especially the onset of heart disease that would increase the mortality rates.[32] it should be noted that self-care could bring about some benefits such as putting a hindrance to early mortality and reducing economic and public health costs.[5]

Despite many efforts in diabetes care, 33–49% of patients still do not meet the requirements for glycemic, blood pressure, or cholesterol control, and only 14% were convincing for all three measures while also avoiding smoking.[31] A study by Carter (2000) clarified that many diabetic patients were not aware of their blood sugar and diabetes control.[33] In Iran, diabetes is at the top of non-communicable diseases, and it is estimated that about 5.2% of people are diabetic.[34]

According to a study conducted by Delavari (2009), self-care status in diabetic patients is in an unfavorable situation.[35] The results of this study showed that there was no significant difference between the two groups regarding gender (P>0/05). However, some studies, including Dashif et. al (2006) found that self-care in women was better than men.[36] And the results of Wallston et. al (2007) illustrated better self-care in men than women.[37] In line with Knight (2006), although knowledge is a necessary condition for behavioral change, it is not enough.[38]

Limitations of this study were differences at the literacy level, cultural and environmental factors that affected factors including glucose monitoring, diet control, physical activity, health-care awareness, and self-care. They could be a new line of inquiry for further research. The importance of self-care in other non-communicable diseases can be emphasized in the first advent of serious complications and the early stages of the disease, therefore, so that they can be prevented.

Conclusion

The importance of self-care behaviors for diabetic patients has made a big contribution to prevent or delay the onset of acute and chronic complications from the disease. Moreover, it could help to raise patients' awareness as to self-care, and self-control. The results of this study showed that blood glucose and diabetes control, physical activity, health care and self-care were reported to be significantly different between two groups of cardiac and non-cardiac diabetic patients (See Figure 1).

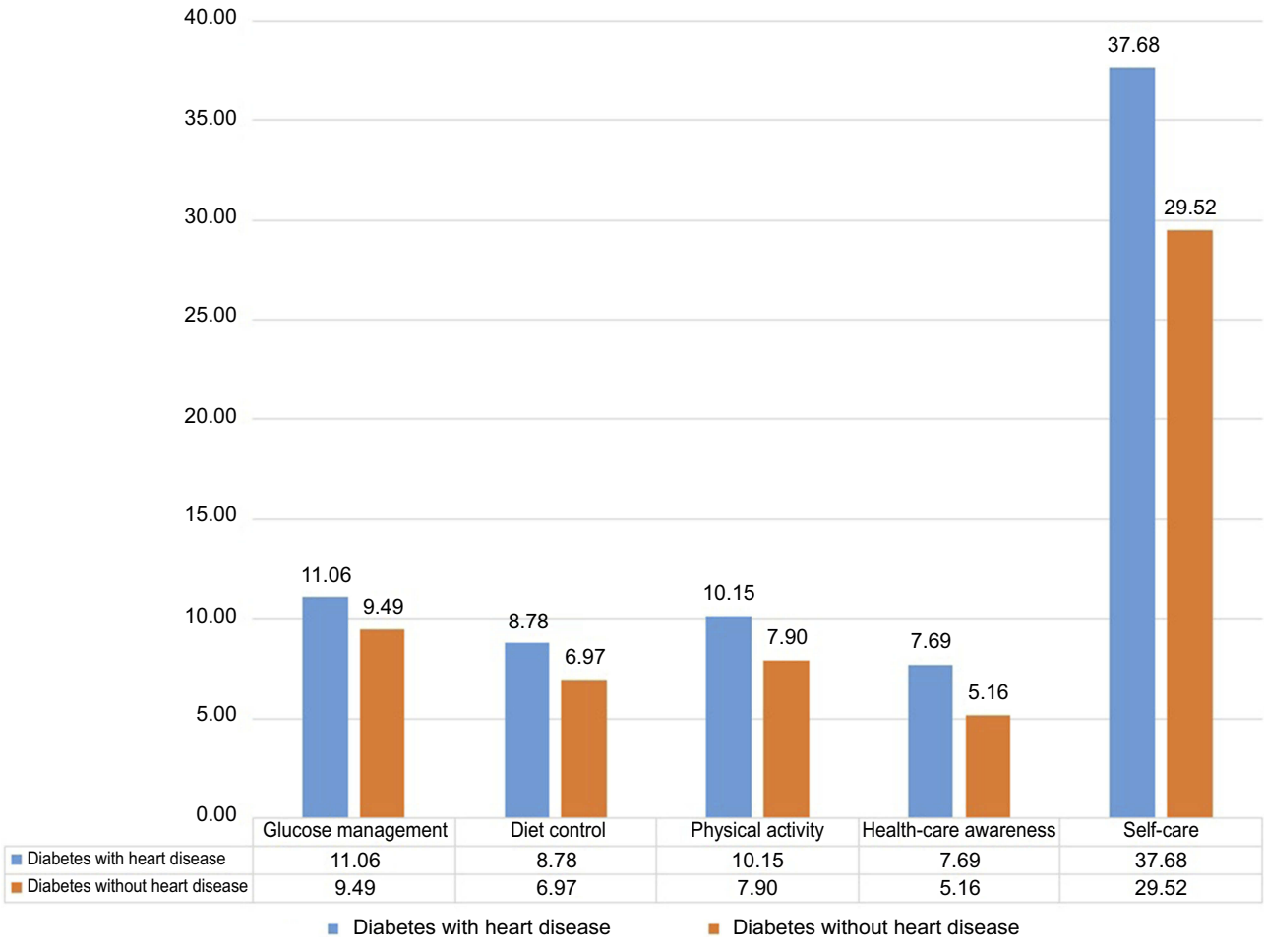

Figure 1 The levels of glucose monitoring, diet control, physical activity and health care awareness in non-cardiac diabetic patients.
Notes: The levels of glucose monitoring, diet control, physical activity and health care awareness are higher in diabetic patients with heart disease compared to non-cardiac diabetic patients.

More training should be allocated by health care providers to improve self-care behaviors in diabetic patients, prevent or delay the onset of complications such as heart disease, high quality of life and reduce health costs in communities.

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Disclosure

The authors report no conflicts of interest in this work.

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