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Using health action process approach to determine diet adherence among patients with Type 2 diabetes

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Abstract:

INTRODUCTION: Diet adherence may cause diabetes complications to be diminished.

OBJECTIVES: This study aimed at identifying determinants of diet adherence among patients with Type 2 diabetes based on the health action process approach (HAPA).

METHODS: In this cross-sectional study, 734 patients with Type 2 diabetes, attending to South Tehran health centers, were recruited during June–December 2018. The dietary regimen scale (nine items) and a researcher-designed questionnaire consisting of HAPA constructs were used to gather the data. Data were analyzed using the Mann–Whitney test, Pearson Chi-squared test, Fisher's exact test, and linear regression test. All statistical tests were assessed using SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA: IBM Corp.).

RESULTS: The level of nonadherence to diet was 91.1%. Diet adherence was significantly associated with family income ($P = 0.005$), level of education ($P < 0.001$), and age ($P = 0.009$). The linear regression showed that 55% of the variance of diet adherence was determined by HAPA variables. Diet adherence was associated with intention ($P < 0.001$), action planning ($P = 0.005$), and barriers ($P = 0.003$).

CONCLUSION: Most of the patients did not adhere to their diet. Appropriate programs should be designed to promote diet adherence among the patients, especially those with low literacy and patients living in poor communities.

Keywords:

Barriers, determinants, diet adherence, health action process approach, Type 2 diabetes

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Introduction

About 422 million people worldwide have diabetes, and it has been estimated that more than 690 million will be afflicted by 2045.[1] In Iran, the prevalence of Type 2 diabetes among adults was rapidly growing from 5.75% in 2010 to 8.7% in 2018.[2] Diabetes, characterized by elevated levels of blood glucose, can potentially lead to serious damages to heart, blood vessels, eyes, kidneys, and nerves over time, if not controlled.[3]

People with diabetes can live longer and healthier when their diabetes is early diagnosed and well managed.[1] The risk of Type 2 diabetes is decreased by healthy eating. One of the main goals in diabetes care in order to reduce diabetes complications and to reach glycemic control is healthy eating.[4] Adherence to healthy diet is the main approach in the management of diabetes.[5] Higher and strong adherence to plant-based dietary patterns and lifestyle recommendations has been reported as successful in lowering the risk of Type 2 diabetes.[6,7] However, diet adherence is a challenge for most of the patients. Diet

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adherence has been reported to be in a range of 44%–74% among patients with Type 2 diabetes.[8-11]

Barriers to diet adherence among patients include cost, lack of support and family issues, low quality of life, urbanization, lack of knowledge, social pressure on eating out, eating problems and negative perspective on diabetes, good support and dyadic adjustment, assessed by partners, poor self-discipline, financial restriction, lack of disease acceptance, and lack of regular blood glucose testing.[8,11-15] Diet regimens are different from patient to patient.[16] Hence, it is essential to consider theories and/or models to best fit the issue. To adhere to the recommendations, one has to become motivated. Motivation guides the self-regulatory process in order to translate a dietary goal into action.[17]

The health action process approach (HAPA) offers that the adoption, initiation, and maintenance of health behaviors should be understood as a structured process including a motivation phase and a volition phase.[18] This model explains that once an intention to change a health behavior is formed, the change should be planned, initiated, and maintained, and relapses have to be managed. After an intention to change or adoption of a particular health behavior has been shaped, the intention has to be transformed into detailed action plans of when, where, and how to perform the desired action.[18]

The HAPA-based studies carried out in Iran have shown seven constructs of HAPA being effective in determining healthful diet for patients with Type 2 diabetes. It explained 81.1% of the total variance.[19] In Australia, MacPhail *et al*. reported that HAPA was effective in predicting health outcomes in patients with Type 2 diabetes; however, it was not effective in improving healthy eating.[20] We aimed to identify determinants of diet adherence based on HAPA, as a conceptual model, among patients with Type 2 diabetes attending to the South Tehran health centers.

Methods

Research design and participants

This cross-sectional study was carried out among 734 patients with Type 2 diabetes referring to the South Tehran health centers from June to December 2018. The inclusion criteria were being diagnosed with Type 2 diabetes for more than 6 months and the absence of any mental, visual, and learning disabilities (according to the clinical diagnosis by a physician) and having consent to participate in the study. The exclusion criteria were a diagnosis of Type 1 or gestational diabetes (not Type 2 diabetes).

Measures

A HAPA questionnaire consisting of 8 sections and 38 items was developed based on the guidelines "Risk and Health Behaviors: Documentation of the Scales of the Research Project" and previous studies.[19,21-25] Intention to diet adherence was assessed using seven-interval Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree) with higher scores indicating high level of intention (two items). Task self-efficacy of diabetes diet adherence was assessed using a four-point scale ranging from 1 (not at all true) to 4 (exactly true) (six items). Coping self-efficacy (seven items), scored for benefits item ranging from 1 (not at all true) to 4 (exactly true), with higher scores determining better condition. Recovery self-efficacy (three items) was rated on a four-point scale ranging from 1 (not at all true) to 4 (exactly true). Aaction planning (two items) and coping planning (six items) were rated on a four-point scale ranging from 1 (not at all true) to 4 (exactly true); scores were recoded to show a better condition. Barriers to adherence (nine items) and resources (three items) were assessed using items ranged from 1 (strongly disagree) to 7 (strongly agree), higher scores represented a high level of barriers and resources. Content validity ratio (CVR) and content validity index (CVI) have been measured by means of a quantitative method in accordance to the Lawshe table.[26] The stability of the items was calculated by intraclass correlation coefficient (ICC). The ICC of 0.4 and above was considered as satisfactory.[27] The CVI >0.9 and CVR >0.9 were accepted. The internal consistency of the HAPA-based questionnaire was high (Cronbach's $\alpha \geq 0.83$). The ICC was satisfactory ($0 > 0.6$).

A reliable and valid nine-item scale was applied to measure patients' adherence to diet.[28] The total score ranged 0–9, with higher scores indicating greater adherence. The first seven items ranged from 0 (never), 0.33 (rarely), 0.66 (sometimes) to 1 (always). The last two items included: "How many days in the last week you could adhere to the prescribed diet?" and "Did you adhere to the prescribed diabetic dietary regimen yesterday?" For scoring, the reported days in the first question were divided into seven. In the second question, positive answer was scored as 1 and negative answer was scored as 0.

The Ethics Committee of Tehran University of Medical Sciences (code: IR.TUMS.SPH.REC.1396.4200) approved the study. Before completing the questionnaires, participants received a complete explanation of the plan and objectives of the study and those willing to participate provided written informed consent.

Statistical analysis

The associations between HAPA constructs and diet adherence were analyzed using the linear regression test. To assess the association between diet adherences with

demographic variables, the Chi-squared test, Fisher's exact test, and Mann–Whitney test were used. $P < 0.05$ was considered statistically significant. All statistical tests were assessed using SPSS (IBM Corp., Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA: IBM Corp).

Based on the mean ± standard deviation of action self-efficacy (14.85 ± 4.91) in a previous study[19] with Type I error (α) 5%, the sample size was calculated 740 individuals by the following formula (D: design effect = 2, d = 10% S = 0.5, $Z_1 - \alpha/2 = 1.96$).

$$n = \frac{Z_1^2 - \frac{\alpha}{2} \times S^2}{d^2} \times D$$

Results

Demographic characteristics

In total, 734 participants met the criteria for inclusion. Table 1 describes the demographic characteristics of the participants. Most of the participants (91.1%) were nonadherent. The mean age of study participants was 61.6 ± 9.7, and 36.9% had primary education. There were significant associations between the diet adherence with the level of education ($P < 0.001$), age ($P = 0.009$), and income status ($P = 0.005$) [Table 1].

Association between diet adherence and the health action process approach constructs

To predict the patients' diet adherence, a linear regression test was used. As shown in Table 2, significant associations were observed between the diet adherence with some HAPA constructs including intention, action planning, and barriers to adherence. Linear regression showed that HAPA constructs could predict 55% of the variance of participants' diet adherence. Behavioral intention ($\beta = 0.32$, $P < 0.001$), action planning ($\beta = 0.17$, $P = 0.005$), and barriers to adherence ($\beta = -0.131$, $P = 0.003$) were predictors of diet adherence in patients with Type 2 diabetes.

Perceived barriers influencing adherence to diet behavior

Table 3 presents the frequency of perceived barriers influencing adherence to diet behavior. According to the results, the main barrier to diet adherence among the patients with Type 2 diabetes was difficult to abandon favorite foods and food habits (76%). The highest percentage was obtained for the first question, "It is difficult for me to avoid banned foods" (69.6%).

Discussion

This study was conducted aiming at identifying the determinants of diet adherence among patients with Type 2 diabetes using HAPA in Tehran, Iran. Our study showed that a significant number of patients (91.1%) were nonadherent to diet. Nonadherence to diet is the main issue among patients with Type 2 diabetes that this may be due to the complexity of diet regimen. Other studies showed a nonadherence to diet range from 74.3%[29] to 87.5%.[30] Diet adherence education in patients with diabetes needs to improve different aspect of diet recommendations and patterns for the management of diabetes. In a study conducted in Denmark, adherence to dietary recommendations (e.g., fiber, saturated fat, vegetables, fruit, and fish) was low in patients with Type 1 and Type 2 diabetes.[31]

Individuals with low income, individuals with low levels of education, and older patients were more nonadherent to diet. In a study conducted by Ayele *et al*., low levels of education and low income were associated with nonadherence to diet among patients with Type 2 diabetes.[29] Evidence shows inconsistency between the studies reporting the relationship between age and adherence. In studies conducted by Yeh *et al*. and Renner *et al*., patient age was associated with diet adherence and older individuals have higher intentions to adhere to healthy diet.[32,33] Aging is related to more experience in managing daily activities as well as initiating behavior changes despite various barriers.[33] While, in a study by Parajuli *et al*., in Nepalese, by increasing age, adherence to diet decreased.[30] This inconsistent finding seems to be due to different contexts of the studies. Therefore, in educational interventions, it is better to focus on messages for different age groups.

Our study showed that among HAPA constructs, intention, action planning, and barriers to adherence were predictors of the diet adherence. Patients with higher intention and action planning and fewer barriers were more adherent to their diet. People who have planned in detail "how," "when," and "how" to adhere to dietary recommendations are more likely to follow their diet. This result is consistent with those conducted by Rohani *et al*.[19] In their study, behavioral intention, action and coping planning, and recovery self-efficacy correlated with healthful diet in patients with Type 2 diabetes.[19] Considering the fact that most of the patients had elementary education or were illiterate, it seems difficult for them to plan their diet adherence. Educational materials and protocols available for patients with diabetes in clinics are the same for individuals with different levels of education. Providing education to patients according to their level of education seems to be helpful in improving their diet adherence.

Determining these predictors helps health educators to design targeted interventions and empower patients to deal with barriers. Behavioral intentions are not sufficient

Table 1: Comparison of diet adherence by demographic characteristics (*n*=734)

Patients' characteristics	Adherent to diet, *n* (%)	Nonadherent to diet, *n* (%)	*P*
Level of education			
Illiterate	15 (5.6)	254 (94.4)	0<001[a]
Elementary	18 (6.6)	253 (93.4)	
Middle school	13 (13.7)	82 (86.3)	
High school	15 (18.3)	67 (81.7)	
University degree	4 (23.5)	13 (76.5)	
Age			
≤45	11 (25.6)	32 (74.4)	0.009[a]
46-55	19 (12.3)	135 (87.7)	
56-65	15 (5.1)	280 (94.9)	
66-75	17 (8.9)	173 (91.1)	
76+	3 (5.8)	49 (94.2)	
Gender			0.322[b]
Female	48 (9.6)	454 (90.4)	
Male	17 (7.3)	215 (92.7)	
Marital status			
Married	53 (8.9)	545 (91.1)	0.522[b]
Single	2 (18.2)	9 (81.8)	
Died	10 (8)	115 (92)	
Job			
Unemployment	0	8 (100)	0.298[c]
Retired	16 (9.2)	158 (90.8)	
Clerk	3 (13)	20 (87)	
Free job	2 (2.9)	68 (97.1)	
Housewife	44 (9.6)	415 (90.4)	
Family income in month (Rls)			
<500,000	1 (1.5)	65 (98.5)	0.005[a]
500,000-1,000,000	7 (6.7)	98 (93.3)	
1,000,000-2,000,000	52 (9.6)	488 (90.4)	
>2,000,000	5 (21.7)	18 (78.3)	
Duration of diabetes (years)			
≤5	17 (7)	227 (93)	0.156[a]
5.01-10	16 (8)	184 (92)	
10.01-15	17 (14.4)	101 (85.6)	
15.01-20	7 (6.2)	106 (93.8)	
20.01+	8 (13.6)	51 (86.4)	
Medications			
OHA	37 (7.5)	455 (92.5)	0.097[b]
Insulin	15 (10.1)	134 (89.9)	
OHA and insulin	13 (14.3)	78 (85.7)	

[a]Mann-Whitney test, [b]Pearson's Chi-square test, [c]Fisher's exact test. OHA=Oral hypoglycemic agents

Table 2: Linear regression analysis to predict diet adherence among participants

Variable	R^2	*B*	SE	*P*	Standardized coefficients β	95% CI	
						Lower limit	Upper limit
Constant	0.55	21.29	4.64	0<001			
Intention		0.328	0.02	0<001	0.431	0.27	0.386
Task self-efficacy		0.018	0.07	0.8	0.016	−0.125	0.162
Coping self-efficacy		0.122	0.07	0.08	0.112	−0.016	−0.259
Recovery self-efficacy		−0.033	0.05	0.559	−0.033	−0.144	0.298
Action planning		0.176	0.06	0.005	0.174	0.055	0.298
Coping planning		−0.002	0.07	0.978	−0.002	−0.142	0.139
Barriers to adherence		−0.131	0.04	0.003	−0.102	−0.217	−0.044
Resources		0.04	0.03	0.256	0.034	−0.029	0.109

R^2=0.55, F=100.85, P<0.05. SE=Standard error, CI=Confidence interval

Table 3: Perceived barriers influencing adherence to diet (*n*=734)

Barriers	Strongly disagree, *n* (%)	Very disagree, *n* (%)	Disagree, *n* (%)	No idea, *n* (%)	Agree, *n* (%)	Very agree, *n* (%)	Strongly agree, *n* (%)
It is difficult for me to avoid banned foods	10 (1.4)	12 (1.6)	18 (2.5)	26 (3.5)	59 (8)	98 (13.4)	511 (69.6)
Buying recommended foods (fresh fruits and vegetables, fish, wholegrain bread, brown rice, etc.) costs me a lot	29 (4)	18 (2.5)	35 (4.8)	87 (11.9)	102 (13.9)	115 (15.7)	348 (47.4)
The oversensitivity of my family to my diet makes me uncomfortable and disrespectful	254 (34.6)	119 (16.2)	112 (15.3)	94 (12.8)	68 (9.3)	29 (4)	58 (7.9)
The doctor or health-care provider does not have enough time to consult my diet and answer my questions	289 (39.4)	168 (22.9)	95 (12.9)	59 (8)	47 (6.4)	43 (5.9)	33 (4.5)
It is difficult to get more than one type of food for the family and I have to eat the same food that the family eats	12 (1.6)	15 (2)	23 (3.1)	35 (4.8)	64 (8.7)	120 (16.3)	465 (63.4)
It is difficult for me to adhere to diet at partying and traveling	12 (1.6)	12 (1.6)	16 (2.2)	37 (5)	75 (10.2)	154 (21)	428 (58.3)
When I get busy at work and/or at home, I forget to follow the diet	17 (2.3)	20 (2.7)	28 (3.8)	54 (7.4)	105 (14.3)	164 (22.3)	346 (47.1)
Diet foods are not delicious	13 (1.8)	28 (3.8)	68 (9.3)	106 (14.4)	128 (17.4)	121 (16.5)	270 (36.8)
It is difficult for me to abandon my favorite foods and food habits	7 (1)	12 (1.6)	8 (1.1)	20 (2.7)	44 (6)	85 (11.6)	558 (76)

to explain behavior and postintentional processes such as planning; so it should be incorporated to explain how people change their behavior.[34,35]

In the present study, 76% of the participants strongly agreed that abandoning their favorite foods and eating habits was difficult. Changing in eating habits is one of the most important lifestyle changes and challenges for patients with diabetes.[36] Eating habits of much delicious foods increase to the reinforcement of craving for these eaten foods.[37] This meant that they have no perceived capability of quitting eating habits and following the diet. It is necessary to increase diet-related self-efficacy in patients with Type 2 diabetes. Another important reason reported by 69.6% of the participants strongly avoiding of prohibited foods was hard. Food cravings can be important barriers to diet adherence in these patients. It shows the importance of focusing on food cravings in designing diet adherence interventions. There are lots of food cues and opportunities to eat in the modern food environment that it can reinforce the impact of food cravings on diet adherence.[38] Hence, improving the perceived capabilities of patients to adherent to diet seems to be necessary. The third reason for nonadherence to diet was difficult to prepare more than one type of food by the family and being forced to eat the same food that the family eats. About 47.4 of the patients reported that they could not buy recommended foods, and patients with low income were nonadherence to diet. Our findings were consistent with the findings of previous studies.[29] A study by Jazayeri and Pipelzadeh among Iranian patients with diabetes found cost as the most frequently cited barrier to diet self-care. The duration of diabetes was a predictor of barriers to diet self-care, as well.[39] It may be useful to provide sufficient information regarding nonexpensive and healthy food alternatives among low-income patients. In a similar study, Vijan *et al*. reported expense of the diet, portion size, quality of life, and family support as barriers to the following dietary recommendations in Type 2 diabetes patients in both urban and suburban areas.[12] These results show that reasons for nonadherent to diet in patients with Type 2 diabetes are varied and identifying these reasons is essential.

For 58.3% of the patients, it was difficult to adhere to diet while partying and traveling. Patients may be adherent in some conditions (e.g., when at home) but nonadherent in others (e.g., when traveling). Hence, adherence should be viewed as a dynamic phenomenon.[16] It seems that people do not behave according to their intentions and their planning. Food cravings may present an important barrier to implementing a diet plan. Further studies on the food cravings of patients with Type 2 diabetes and training in mindfulness regarding diet adherence are also recommended. In a study conducted by Dalton *et al*., food cravings were the most commonly mentioned reason for nonadherent to diet.[40] The mindful eating intervention can affect diet adherence in patients with Type 2 diabetes.[38] The study of Cradock *et al*. showed that changing or controlling dietary environmental agents were more than twice as effective in reducing hemoglobin A1c than diets using behavioral change interventions in patients with Type 2 diabetes.[41]

Health-care providers can improve intention, action planning, and barriers among patients with Type 2 diabetes through theory-based interventions to help them promote their diet adherence, which, in turn, reduces hospitalization and physician services and health-care costs in the long time.

In this study, we identified a series of cognitive factors that can predict medication adherence. These cognitive

factors that facilitate or hinder diet adherence behavior and should be considered by the diabetes program planners.

In this study, factors influencing diet adherence among patients with Type 2 diabetes according to the HAPA were identified. Data were collected using face-to-face interview, which was helped to gather valid data from low literate patients. Most available studies have worked on health behavior changes at the same time, regarding the health behavior models and/or theories. This study identified the constructs of HAPA that can help health program planners to develop interventions that may be more effective in maintaining the interventions effects. Our study had some limitations. First, measuring diet adherence based on self-report questionnaires may cause recall bias and overestimate patients' diet adherence rate. Second, it should be careful about interpreting the associations and direction of associations from a cross-sectional survey. Another limitation of this study is that the results of our study are only relevant to the south parts of Tehran, and there are no accurate statistics on patients' diet adherence status in the north parts of Tehran.

Conclusion

Our study showed that nonadherence to diet among patients with Type 2 diabetes was extremely high. We found intention, action planning, and barriers to adherence as the most important determinants related to the diet adherence among patients with Type 2 diabetes. Adherence to diet was associated with age, educational level, and income in patients. Designing interventional programs aiming at promoting diet adherence level considering these determinants are promising. Diabetes educators should have a specific focus on patients' intention, action planning, and barriers of diet adherence while designing such interventions.

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Conflicts of interest

There are no conflicts of interest.

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