Original Article

Readiness for diet change and its association with diet knowledge and skills, diet decision making and diet barriers in type 2 diabetic patients

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ABSTRACT

Aims: to investigate stages of change for dietary in type 2 diabetics and its associations with diet knowledge and skills, diet decision making and diet barriers.
Materials and methods: This was a cross-sectional study which was conducted on 1139 diabetics aged>18 years in East Azerbaijan, Iran. Data were collected through a Personal Diabetes Questionnaire (PDQ) and analyzed through SPSS version 22 software using descriptive statistics, Chi-square and one-way ANOVA tests. Tukey's HSD post hoc tests were applied to illustrate ANOVA findings.
Results: 59.3% of patients do not follow a diet plan to control their blood glucose. 44.7%, 5.5%, 13%, and 36.8% of patients, respectively, were in the stages of pre-contemplation, contemplation, preparation and action. Patients who had shorter disease duration and those whose current treatment was lifestyle change were more likely within the action stage. Also, patients who had a higher score in diet knowledge and skills and diet decision making and those who had a lower score in diet barriers were more likely in the action stage of change.
Conclusion: Based on the results of this study, a considerable proportion of diabetic patients were in the pre-contemplation stage. Diet knowledge and skills, diet decision making and diet barriers were factors contributing to diet readiness to change. Therefore, taking necessary measures to increase diet knowledge, skills and diet decision-making and a reduction in diet barriers can help people with type 2 diabetes to change diet.

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1. Introduction

Diabetes is a global and growing problem and predictions indicate that it is the 7th cause of death in the world by 2030 [1].

Although the disease is a problem in all countries, it is associated with more and worse outcomes in low-income countries [2].

Successful management in diabetes can prevent or postpone complications [3]. The responsibility of diabetes management is more on the individual than the medical team [4]. Prevention of Type 2 diabetes is directly related to people's health behaviors including HbA1c levels, diet, physical activity, and weight control. Hence, improving self-care of at-risk people and patients as an integral part of proper blood glucose control can play an important role in controlling these diseases. Enhancement of self-management behaviors has emerged as a focal point of care for health care providers [5—7]. Diabetes self-management (DSM) is an

important element in the overall management of type-2 diabetes (T2DM) [8] and its self-management education programs are often line in with behavior-change theories [9].

One of the most important factors in preventing diabetes is a healthy diet. Interventions to change diabetes diets can improve glycemic control, but these interventions are sometimes coming along with patient resistance [10]. Unfortunately, poor diets are often seen in people who have limited access to a healthy diet, diabetes education, and less awareness of self-management strategies which makes it difficult to implement such interventions [10,11]. For the same reason, sometimes the dietary plans recommended by the service providers are not easily accepted by the people. To overcome these problems, understanding the views of people is very important and can facilitate the implementation of such plans [12].

In order to improve self-management behavior, the International Diabetes Federation (IDF) has introduced a framework that emphasizes knowledge about lifestyle modification, problem-solving approach and individual self-management [13]. In line with this framework, many models have been proposed, one of which is the transtheoretical model (TTM), which is developed by Prochaska and Di Clemente. This model offers a comprehensive theoretical framework determining readiness to change (RTC) This model defines the relationships between the stages and the processes of change, decisional balance, self-efficacy, and relapse. The stages of change of the TTM are: pre-contemplation, Contemplation, Preparation, Action, and Maintenance, in which individuals move forward and at times backward, re-starting the cycle. Although individuals may go back to a stage they had already been through, previous experiences still constitute an effective step for the change of behavior. This is the reason why the model is best depicted as a spiral [14–16].

Moreover, the model is utilized to understand how individual differences impact on readiness to change health behavior. In addition, using this model, service providers can reach the views of individuals at the time of medical encounter [15,17]. The model consists of 5 stages (pre-contemplation, contemplation, preparation, action and maintenance) that help individuals move toward behavior engagement. The model suggests the readiness to change behavior and self-efficacy taking into account individual differences [17,18].

It is highly recommended to promptly assess motivation and readiness to change (RTC) in individuals who wish to achieve significant lifestyle behavior changes in order to improve their health, overall quality of life, and well-being [19]. The contribution of diabetes self-efficacy, as emphasized in the TTM, for dietary change is assessed in order to better understand factors influencing in individual readiness to change diet. A final goal is to determine the utility of brief clinical measures in the assessment of self-management behaviors and readiness to change, with the potential for guidance towards stage-based interventions in underserved clinical samples [7]. So, this paper aims to investigate stages of change for dietary habits in type 2 diabetics and associations between stages of change for dietary, diet knowledge and skills, diet decision making and diet barriers.

2. Methods

2.1. Study design and sample

This was a cross-sectional study conducted on type 2 diabetic patients aged >18 years without any physical and mental disabilities in East Azerbaijan province, Iran. 1200 type 2 diabetic patients were recruited by consecutive sampling method from educational hospitals, diabetes clinics and primary healthcare centers affiliated to Tabriz University of Medical Sciences and private endocrinologist offices.

2.2. Data collection tools and scoring

We used a Personal Diabetes Questionnaire (PDQ) for data collection. This questionnaire is a measure of diabetes self-care behaviors, perceptions and barriers which includes diabetic eating habits, medicines, blood glucose testing, and physical activity. The PDQ is a brief, yet the comprehensive measure of diabetes self-care behaviors, perceptions and barriers. The Development and initial evaluation of the psychometric properties of the PDQ were assessed by Stetson et al. Subscales demonstrated good internal consistency (Cronbach$\alpha = 0.650-0.834$) and demonstrated significant associations with BMI ($p \leq .001$) and HbA1c ($p \leq .001$) [20].

We used part C (Diet Knowledge and Skills) for dietary practices regarding type of diet information utilized to guide eating behavior (sum C1–C9: higher score indicates greater knowledge and skill); part D (Diet Change Readiness): Readiness for change for attempting dietary self-management ("Pre-contemplation" if D3 = 4; "contemplation" if D3 = 3; "preparation" if D3 = 2; "action" if D1 = 1 D2≥1 or D3 = 1); part E (Diet Decision Making): general diet-specific decision making strategies used (For individuals on insulin: sum E1-E6, for individuals not on insulin: sum E1-E4 and E6. Higher score indicates more frequent use of strategies); part F (Eating Problems): Eating behavior patterns that interfere with self-management; (sum F1–F3: higher score indicates more frequent problems); and part G (Diet Barriers): Environmental, social, and emotional factors interfering with attempts to adhere to regimen (sum G1-G7: Higher score indicates more frequent barriers).

2.3. Data collection

After approving the study protocol in the Ethics Committee of the University, the questionnaires were given to the participants by referring to the treatment centers. Moreover, the required explanations were given to the patients about the objectives of the study and how to complete the questionnaire. In the case of illiterate people, the questionnaire was read by an interviewer to the participants while they completed their questionnaire.

2.4. Statistical analysis.

Data analyzed using SPSS software version 22. Demographic characteristics and readiness to change was defined using descriptive statistics. Chi-square test was used to examine the relationship between demographic and clinical variables with readiness to change stages. Between-group differences were assessed using one-way ANOVA tests. Tukey's HSD post hoc tests were applied to elucidate significant ANOVA findings.

2.5. Ethics consideration

The protocol of the study was approved by the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1397.166). The authors ensured that all questionnaires will remain confidential and unnamed. Verbal informed consent was obtained from all patients and participation in the study was voluntary.

3. Results

Demographic, clinical profile and stage of change characteristics are shown in Table 1. Most of the participants were female (66.3%).

Table 1
Demographic characteristics of the participants.

variable	category	Frequency	percent
Gender	Male	384	33.7
	Female	755	66.3
Age	<40	127	11.2
	40–60	527	46.3
	>60	485	42.6
Marital status	Married	933	81.9
	Single	206	18.1
Income status	<10 million Rials	397	52.5
	>10 million Rials	359	47.5
Education status	Illiterate	473	41.5
	Reading and writing ability	407	35.7
	Diploma	195	17.1
	Academic education	64	5.6
Type of basic health insurance	Social security insurance	707	64.4
	Iranian health insurance	391	35.6
Supplementary health insurance coverage	Yes	430	39.1
	No	669	60.9
Habitation status	Rural area	135	11.9
	Urban area	1003	88.1
Smoking status	Yes	121	10.6
	No	1018	89.4
Body Mass Index (BMI)	Normal weight	302	26.9
	Overweight	445	39.7
	Obese	374	33.4
Disease duration	<5 year	421	37.1
	5–10 years	260	22.9
	>10 years	455	40.1
Type of current treatment	Oral agents	619	54.3
	Insulin	449	39.4
	Change in lifestyle (change in diet and physical activity)	71	6.2
Presence of co-morbidity or complications	Yes	867	76.1
	No	272	23.9
The history of hospitalization due to complications of diabetes during the past year	Yes	344	30.2
	No	795	69.8
Currently trying to follow a diet plan in order to better control of blood glucose	Yes	673	59.3
	No	462	40.7
Type of following the diet plan in order to better control of blood glucose	Carbohydrate counting	5	1.1
	The food exchange system	13	2.8
	Total available glucose (TAG)	19	4.1
	Healthy foods	339	73.4
	The food guide pyramid	43	9.3
	Fat gram counting	2	.4
	Other	41	8.9
Diet Readiness To Change (RTC)	Pre-contemplation	508	44.7
	Contemplation	62	5.5
	Preparation	148	13.0
	Action	418	36.8

The mean ± SD of age, disease duration and BMI was 56.93 ± 13.34, 9.06 ± 7.12 and 28.37 ± 5.25, respectively. Given that this was a cross-sectional study and the assessment, the results for maintenance stages were excluded from the analysis because longer time was required for follow up.

59.3% of patients claimed currently trying to follow a diet plan in order to better control of blood glucose and 73.4% of patients claimed following Healthy Foods diet plan in order to better control of blood glucose. However, only 36.8% of them were in the action stage of diet change, and approximately half of them (44.7%) were in the pre-contemplation stage.

The most common barrier to diet was a problem with following diet plan when people feeling stress, depression, anger and exhausting (2.7 ± 1.56). The most common problem with eating was eating unplanned snacks (2.5 ± 1.28). (Table 1).

The results of Chi-square test showed that disease duration ($x^2 = 21.97$, P = .001), history of hospitalization due to diabetes complications ($x^2 = 8.75$, P = .03), presence of co-morbidity or complications ($x^2 = 9.67$, P = .02) and type of current treatment ($x^2 = 12.51$, P = .05) were significantly associated with the stage of

diet change. Patients with shorter disease duration, no history of hospitalization, no presence of co-morbidity or complications and those whose current treatment based on lifestyle change were more frequently in action stages. Other included variables did not differ based on the stage of diet change. (Table 2).

The results of one-way ANOVA test showed that diet knowledge and skills (F = 82.18, p < .0001), eating problems (F = 4.55, p = .004), diet barriers (F = 3.23, p = .019) and diet decision making (F = 66.75, p < .0001) had a significant difference based on stages of diet change.

The results of Tukey's SDH post hoc test indicated that those who were at the stage of action have a higher diet knowledge and skills than those who are at the other stages (p < .0001) and other stages had no significant difference (p > .05). People who were at the action stage had fewer eating problems than those who are in the other stages (p = .004). Most of the eating problems were related to the group that was in the stage of preparation. Also, People who were at the action stage had fewer dietary barriers than those who are in the other stages (p = .01). There was a significant difference in terms of dietary barriers among those who were in the

Table 2
K2 results by stage of change for dietary dependent demographic, socioeconomic and clinical variables.

Variables	Categories	pre-contemplation	contemplation	preparation	action	x^2	P value
Gender	Male	178 (46.5%)	18 (4.7%)	49 (12.8%)	138(36.0%)	1.12	.771
	Female	330 (43.8%)	44 (5.8%)	99 (13.1%)	280(37.2%)		
Age (years old)	<40	48 (37.8%)	10 (7.9%)	17 (13.4%)	52 (40.9%)	10.70	.09
	40−60	221 (42.2%)	2 (5.3%)	79 (15.1%)	196 (37.4%)		
	>60	239 (49.3%)	24 (4.9%)	52 (10.7%)	170 (35.1%)		
Marital status	Single	100 (48.5%)	14 (6.8%)	32 (15.5%)	60 (29.1%)	6.88	.07
	Married	408 (43.9%)	48 (5.2%)	116 (12.5%)	358 (38.5%)		
Smoking status	Yes	54 (44.6%)	7 (5.8%)	16 (13.2%)	44 (36.4%)	.03	.99
	No	454 (44.7%)	55 (5.4%)	132 (13.0%)	374 (36.8%)		
Disease duration	<5 years	156 (37.1%)	24 (5.7%)	69 (16.4%)	172 (40.9%)	21.97	.001
	5−10 years	121 (46.7%)	11 (4.2%)	34 (13.1%)	93 (35.9%)		
	>10 years	231 (51.0%)	27 (6.0%)	43 (9.5%)	152 (33.6%)		
Education status	Illiterate	225 (47.7%)	18 (3.8%)	68 (14.4%)	161 (34.1%)	14.87	.09
	Reading and writing ability	163 (40.2%)	26 (6.4%)	59 (14.6%)	157 (38.8%)		
	Diploma	90 (46.2%)	14 (7.2%)	16 (8.2%)	75 (38.5%)		
	Academic education	30 (46.9%)	4 (6.3%)	5 (7.8%)	25 (39.1%)		
Income status	<10 million Rials	176 (44.6%)	22 (5.6%)	53 (13.4%)	144 (36.5%)	1.87	.59
	>10 million Rials	162 (45.3%)	16 (4.5%)	39 (10.9%)	141 (39.4%)		
Habitation status	Urban area	438 (43.8%)	58 (5.8%)	128 (12.8%)	377 (37.7%)	5.30	.15
	Rural area	69 (51.5%)	4 (3.0%)	20 (14.9%)	41 (30.6%)		
Type of basic health insurance	Social security, armed force and relief	311 (44.2%)	39 (5.5%)	94 (13.4%)	260 (36.9%)	.30	.95
	Iranian health insurance	173 (44.2%)	23 (5.9%)	48 (12.3%)	147 (37.6%)		
Supplemental insurance coverage status	Yes	187 (41.7%)	31 (6.9%)	53 (11.8%)	177 (39.5%)	6.65	.08
	No	321 (46.7%)	31 (4.5%)	95 (13.8%)	241 (35.0%)		
Awareness about cause of type 2 diabetes	Yes	427 (44.1%)	57 (5.9%)	131 (13.5%)	353 (36.5%)	4.23	.23
	No	81 (48.2%)	5 (3.0%)	17 (10.1%)	65 (38.7%)		
Body mass index (BMI	Normal weight	139 (46.0%)	11 (3.6%)	43 (14.2%)	109 (36.1%)	6.08	.41
	Overweight	207 (46.7%)	29 (6.5%)	52 (11.7%)	155 (35.0%)		
	Obese	155 (41.6%)	22 (5.9%)	51 (13.7%)	145 (38.9%)		
Disease severity	Sever	300 (45.0%)	36 (5.4%)	96 (14.4%)	235 (35.2%)	8.07	.23
	Moderate	106 (45.7%)	17 (7.3%)	27 (11.6%)	82 (35.3%)		
	Low	102 (43.0%)	9 (3.8%)	25 (10.5%)	101 (42.6%)		
The history of hospitalization due to complications of diabetes during the last year	Yes	149 (43.4%)	29 (8.5%)	41 (12.0%)	124 (36.2%)	8.75	.03
	No	359 (45.3%)	33 (4.2%)	107 (13.5%)	294 (37.1%)		
Presence of co-morbidity or complications	Yes	184 (41.3%)	34 (7.6%)	65 (14.6%)	162 (36.4%)	9.67	.02
	No	324 (46.9%)	28 (4.1%)	83 (12.0%)	256 (37.0%)		
Type of current treatment	Change in lifestyle (change in diet and physical activity)	22 (31.0%)	3(4.2%)	10 (14.1%)	36 (50.7%)	12.51	.05
	Oral agents	278 (45.1%)	33(5.3%)	92 (14.9%)	214 (34.7%)		
	Insulin	208 (46.4%)	26(5.8%)	46 (10.3%)	168 (37.5%)		

stage of action (p = .01) than those at the stage of preparation. Those who were at the action stage have a higher diet decision-making score than those who are at the other stages (p < .0001) and other stages had no significant difference (p > .05). (Table 3).

4. Discussion

This study aimed to examine the status of the readiness stages for dietary change in patients with type 2 diabetes and the effect of diet knowledge and skill, eating problems, dietary adherence barriers and diet decision making on the stages of readiness to dietary change. The results indicated that nearly half of the patients were within the pre-contemplation stage. This means that half of the patients did not even think of dietary change as a way to control of blood glucose, and these patients were lacking adequate awareness about the importance of diet adherence to better control of blood glucose.

59.3% of patients claimed currently trying to follow a diet plan in order to better control of blood glucose. However, only 36.8% of them were in the action stage to change the diet, and more than half of them were in the pre-contemplation and contemplation stages. This suggests that although a high percentage of patients were followed up a diet, only a small proportion of them were in the action stage of dietary change, as a result, many of them were lacking adequate readiness to dietary change. In Greene et al. study, 79% of patients reported usually following their eating plan; however only 40% were within the action or maintenance stage for dietary fat reduction, also Post hoc results (Scheffe) revealed that subjects in action or maintenance used more fat reducing behaviors, consumed more fruit and vegetables, and monitored carbohydrate intake to a greater extent than subjects in pre-contemplation or contemplation (p < 0.05) [21]. In Bawadi et al. study there was high degree of readiness toward consuming diets with less saturated fat and simple sugar, while half of the

Table 3
ANOVA results by stage of change for dietary dependent variables.

Variable	pre-contemplation	Contemplation	Preparation	Action	F	P value
Diet Knowledge and Skills	37.47 ± 21.15	37.34 ± 20.17	37.03 ± 20.70	58.59 ± 23.25	82.18	<.0001
Eating Problems	19.80 ± 22.32	21.63 ± 20.60	23.31 ± 21.14	16.48 ± 19.61	4.55	.004
Diet Barriers	23.58 ± 18.28	24.21 ± 15.93	26.99 ± 18.29	21.78 ± 16.23	3.32	.01
Diet Decision Making	31.80 ± 19.65	35.68 ± 20.71	33.49 ± 19.77	51.37 ± 24.79	66.75	<.0001

participants (50.9%) were in the pre-contemplation stage for consuming ≥5 servings of fruits and vegetables every day, also in their study very low degree of readiness was reported for self-monitoring of blood glucose on a regular basis and for practicing physical exercise [22]. A study by Holmen et al. indicated that 58% were in the pre-action stage for physical activity change and 79% in the preaction stage for dietary change. Higher scores of self-management were associated with an increased chance of being in the action stage for both dietary change and physical activity change. Approximately half of the participants were in the pre-action stage for physical activity change and dietary change. This means that they were not currently in a behavior change process. Being in the action stage for physical activity change and dietary change was independently associated with higher scores of self-management, crucial for diabetes [23].

Diet knowledge and skills, as well as diet decision making, were significantly higher among patients who were within the action stage of dietary change than those who were within other stages of change, while no significant difference was found in diet knowledge and skills, and diet decision making among those who were in other stages of change. Patients who were in the action stage had fewer eating problems and dietary adherence barriers, the more eating problems and dietary adherence barriers patients have, the less likely they follow the stages of diet change. Further, most eating problems and dietary adherence barriers were in the preparation stage. It seems that when patients are prepared for dietary change, they would have more likely to perceive eating problems and dietary adherence barriers. In other words, eating problems and dietary adherence barriers had the most impact on the preparation stage of dietary change.

Consequently, an increase in diet knowledge and skills and diet decision making, as well as a reduction in eating problems and dietary adherence barriers result in diabetic patients would be more involved in dietary change. Therefore, designing educational interventions based improvement of diet knowledge and skills, diet decision making in diabetics, as well as measures in order to reduce dietary adherence barriers and eating problems can be beneficial in individuals' success in completing the stages of dietary change. In a study by Chapman et al., patients with higher knowledge were more likely to be involved in the action stage [4]. While in a study by Gordon et al. a significant difference was found in pre-contemplation and contemplative groups in terms of knowledge and attitude [17]. In Centis et al. study, participants in the action stage endorsed fewer behavioral dietary barriers (p < .001), more frequent dietary problem-solving (p < .001), and greater diabetes self-efficacy (p < .001) compared to participants in the Contemplation and Preparation stages [2]. Also, in Greene et al. study, post hoc analyses (Scheffe) revealed that subjects in action or maintenance used more fat reducing behaviors, consumed more fruit and vegetables, and monitored carbohydrate intake to a greater extent than subjects in pre-contemplation or contemplation (p < 0.05) [21]. Another study reported that participants in the Action stage endorsed fewer behavioral dietary barriers (p < .001), more frequent dietary problem-solving (p < .001), and greater diabetes self-efficacy (p < .001) than participants in the Contemplation and Preparation stages [1]. In a study by Chapman-Novakofski et al. improvement in knowledge was instrumental in moving individuals to an action or maintenance stage and in improving self-efficacy [6].

According to the findings, none of the demographic characteristics (gender, age, income status, education status, habitation status and marital status) was significantly associated with the stages of dietary change. This may be because most included patients in this study were the elderly, women and patients with a low level of income and education. A study by Knight et al. showed

that women are more likely to be in the preparation stage for change and beyond than their men counterparts [1]. In Centis et al. study there was a significant difference between the stages of change for healthy diet, habitual physical activity and age, as well as gender and, males scored higher in maintenance, whilst females scored higher in discrepancy (P < 0.01) and lower in self-efficacy in both HD and HPA, as well as higher in temptation towards sedentary lifestyles, also expressed by lower stabilization-of-change [2]. While another study showed no significant differences between groups were detected with relation to age, gender and education level [17]. In Bawadi et al. study age, gender, income and education were all associated with the stage of change of the consuming 5 servings or more of fruits and vegetables; decreasing intake of refined sugar and reducing saturated fat (p < 0.01) [22].

Patients with higher body mass index (BMI) were more likely to be in the action stage of dietary change, but this difference was not statistically significant. According to Holman et al. those with higher body mass index would have a greater chance to follow the stages of diet change, while BMI was associated with an 8% reduced chance of being in the action stage for physical activity change (OR 0.92, 95% CI 0.86 to 0.99) [23], while in a study by Centis et al. resistance to change toward healthy diet (HD) was greater among those with higher body mass index (BMI) [2]. In a study by Gordon et al. no significant differences were revealed between studied groups and body mass index [17].

In this study, patients with shorter disease duration were more likely to be in the action stage of dietary change, meaning that measures based on dietary change seems to be more effective in the early stage of the disease, so focusing on dietary change interventions in the early stage of disease diagnosis can increase the probability of success in completing the stages of dietary change among diabetic patients. A study by Parchman et al. showed that the effect of educational interventions on following up the stage of change was more effective for those with a shorter duration of diabetes [5]. Also, Centis et al. showed a significant difference between the stages of change healthy diet, habitual physical activity and disease duration, and subjects with long-lasting T2DM (≥10 years) were much less prone to change their diet, with much lower determination scores, in comparison with patients with more recently diagnosed disease (on average, −18 points; P < 0.001) and to subjects with diabetes duration 1−10 years (−12 points; P < 0.001) [2].

According to the findings, a significant difference was revealed between the stages of dietary change with regard to the history of hospitalization during the past year and the presence of diabetes complications. But the results of the descriptive statistics did not show a considerable difference. Moreover, diabetic patients' education regarding complications and negative consequences of non-adherence to diet and its effect on the incidence or exacerbating the disease complications can be effective in individuals' perception about diabetes as well as more effort towards dietary change adherence. In Centis et al. study a significant association was seen between stages of changes and presence and the number comorbidities [2], while, in Sina et al. study barriers to self-care were significantly more common among those with, than those without, diabetes complications [24].

In this study, those whose main treatment strategy was based on lifestyle change (change in diet and physical activity) were more likely to be within the action stage of dietary change, whereas those whose main treatment strategy was insulin-based and oral agents-based were more likely to be in the pre-contemplation stage. This indicates that if the diabetes treatment process is to concentrate on self-care measures and lifestyle modification, individuals would be more likely to follow the stages of diet change. Therefore, in addition to design diet change interventions, attention to system factors

and the pivotal role of service providers, patient-related factors and disease-related factors are necessary. Also, measures for persuading providers to focus more on providing self-care and lifestyle modification should be undertaken.

5. Conclusion

Given the high proportion of individuals in the pre-contemplation stage, it can be concluded that dietary change has not been perceived as a necessary part of the treatment process in the majority of diabetic patients, so designing appropriate educational interventions is necessary for diabetic patients' knowledge regarding the important role of dietary modification in blood glucose control. Focusing on dietary change interventions, on the other hand, in the early stage of disease diagnosis can increase the likelihood of success in completing the stage of dietary change in diabetic patients. Moreover, service providers should focus more on lifestyle change as the main treatment strategy in managing diabetes. The result of this study indicated that an increase in diet knowledge and skills and diet decision making, and a reduction in eating problems and dietary adherence barriers can increase the probability of success in following the stages of dietary change. Thus, measures such as designing educational interventions for improving diet knowledge and skills and diet decision making in diabetic patients, as well as measures for reducing dietary adherence barriers and eating problems can be effective in individuals' success for dietary change.

Limitations

This study had several limitations. Since the list of all patients was not available, and access to all patients was not impossible, random sampling was not possible. So, a sequential sampling method was used in this study. Also, due to the cross-sectional design of the study, the maintenance stage was not investigated in the study.

Conflicts of interest

There is no conflict of interest in this study.

Acknowledgements

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.dsx.2019.07.065.

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