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Predicting dietary behavior of type 2 diabetics: Application of the theory of planned behavior and perceived risk of diabetes complications construct

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Original Article

Abstract

BACKGROUND: Diabetes mellitus (DM) is considered a major health problem due to its complications. However, it could be prevented or delayed by modifications in the patients' behavior and diets. The objective of this study was to explore the utility of the theory of planned behavior (TPB) and complications of diabetes perceived risk to find modifiable diabetes-related beliefs in order to make behavioral changes feasible.

METHODS: The present descriptive-analytical cross-sectional study was conducted in diabetes clinics in Semirom, Iran, based on TPB and complications of diabetes perceived risk using a self-administered questionnaire. A total of 154 patients with diabetes without complications of diabetes participated in the study. Measured variables were patients' attitude, subjective norm, perceived behavioral control, complications of diabetes perceived risk, intention to maintain a healthful diet and nutritional style. Structural equation modeling was used to analyze data.

RESULTS: The results revealed that the TPB and perceived risk of diabetes complications fitted the data acceptably well among patients with type 2 diabetes and within dietary behavior. Perceived behavioral control, subjective norm, perceived risk of diabetes complications, and intention to maintain a healthy diet were related to healthy diet behavior. No relation was found between attitude and intention to follow a healthy diet.

CONCLUSION: The TPB and perceived risk of diabetes complications is a useful theory in determining intentions of patients with diabetes and their adherence to a healthy diet.

KEYWORDS: Type 2 Diabetes, Diet, Theory of Planned Behavior

Introduction

Despite the many efforts, the percentage of people with complications of diabetes mellitus (DM) has increased not only in Iran[1], but also around the world.[2] Experts predict that the

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diabetic population will have increased to 9 million by 2021.[3] The World Health Organization (WHO) estimates an annual incidence of 4 million deaths due to diabetes, in other words, 7 diabetic patients die per minute due to its complications.[4] This issue imposes high costs on countries especially their health systems.

According Harris, DM management is the best method to preclude and delay its complications.[5] It can reduce the burden of the complications of this disease in society. Patients with DM should choose a suitable diet that permanently changes their beliefs, and dietary habits and patterns, but these patients rarely comply with a suitable diet as a habitual behavior.

Some studies report low adherence to healthy diets such as eating micronutrients, fruits, and vegetables among patients with DM.[6-8] According to a study conducted in Greece, most type 2 diabetics scarcely use a Mediterranean diet that is rich in vegetables, fruits, fish, cereals, and olive oil.[9] Diabetics try to improve their diet, but often inappropriately. This may be due to the contradictory recommendations derived from various sources such as health personnel, the national media, and social community.[10]

Presently, there are many diabetic clinics around the world that offer recommendations to improve preconception of health and health-care, without considering the patients' beliefs and attitudes, and help them to select a suitable diet pattern. Anderson and Funnel reported that health improvement of patients who suffer from chronic diseases such as diabetes, unlike acute diseases, is likely obtained by themselves, not by physicians or other health care providers.[11] Therefore, recognition of intrapersonal factors related to appropriate diet behavior may lead to increased effectiveness of controlling disease education and decreased complications.

The aim of this study was to use the theory of planned behavior (TPB)[12] as a type 2 diabetic's perceptual and belief framework that measures and empirically assesses behavior toward a healthy diet. According to this theory, health-related behaviors can be predicted through the structure of intention to perform the behavior. This structure is affected by attitude, subjective norm, and controlling perceptual behavior.[13] Many studies have been performed through applying the TPB on diabetics' healthy behavior.[14-16] However, it is necessary to test theoretical frameworks in the target population to identify factors that can be handled in order to achieve optimal behavioral change.[17] The objective of this study was surveying the efficiency of TPB in terms of the perception of suitable dietary behavior among type 2 diabetics in Iran.

Materials and Methods

This cross-sectional study was conducted in 2014. The target population consisted of 154 diabetics without complication who referred to diabetic clinics in the health network of Semirom, Iran. The inclusion criteria were patients with type 2 diabetes who were registered in primary health-care centers and were willing to participate in the study. The exclusion criteria were patients with complications such as foot ulcer and blurred vision according to their physician and incomplete questionnaires. The amount of ratio of studied character was considered 50% in the society, so maximum sample size was obtained. A sample size of 150 was determined in the present study based on 95% confidence level and error limit of 8%, and using the following formula:

$$\left(\frac{z_{1-\frac{\alpha}{2}}^{2} \times p(1-p)}{d^{2}}\right)$$

To obtain this number of participants, random sampling was performed among patients referred to diabetic clinics of primary

health-care centers in Semirom. To assess the structure of the TPB in relation to a suitable diet in diabetics, the standardized questionnaire validated and approved by Rohani et al. was employed.[18] Variables of this questionnaire were defined based on the structure of TPB.[12] This questionnaire includes 5 questions on demographic characteristics, 2 questions comprising 8 items on indirect measurement of attitude structure (behavioral belief and outcome evaluation) (each question consists of), 2 questions comprising 6 items on structure of indirect subjective norm (normative belief and motivation to follow) (each question has), 2 questions comprising 8 items on structure of indirect measurement of perceived behavioral control (perceived power and belief's control), 1 question with 3 items for measurement of structure of treatment intention, and 1 question with 3 items for measuring the structure of perceived risk of diabetes complications. Answers in all items were scored on a 5-point scale ranging from 1 (totally agree, very unlikely), to 5 (totally agree and very likely). It should be noted that to obtain participants' scores in structures of attitude, subjective norm, and perceived behavioral control which had two subscales, the scores of relative questions in each subscale were multiplied and added. For other structures, the total score obtained from items was considered as a participant's score. To assess healthy dietary behavior, the Nutritional Style Scale designed by Lippke and Ziegelmann in 2006 was used.[19] This scale includes 19 questions scored based on a 4-point scale ranging from 1 (totally false) to 4 (totally true). Higher total scores obtained from this scale illustrate participants' healthier nutritional style. To localize the Nutritional Style Scale, first, two experts translated it from English to Persian. Then, four nutritionists checked its content and determined which questions were necessary, which were useful but unnecessary, and which questions should

be deleted. Subsequently, they determined whether these questions could show studied concepts (heeding healthy diet) or not. Moreover, the clarity, briefness, and cultural appropriateness of each question were checked and some recommendations were considered. Based on the experts' suggestions, one question about nutritional style that was unclear was deleted. To assess the validity of this questionnaire, some participants completed it and provided suggestions for simplicity and comprehensibility. To assess the interior and exterior reliability of this questionnaire, 15 participants of the target group completed it twice with a 2-week interval. Results showed that this questionnaire is reliable (Cronbach's alpha was equal to 0.71 and correlation from the test-retest was equal to 0.730). After obtaining permission and coordinating with the related authorities, interviewers distributed the questionnaires among the participants. The participants received face-to-face training and pamphlets about a healthy diet and followed the training. Then, the participants completed the questionnaires. If they had any disabilities, the questionnaire was completed through interviews by the clinic's health care personnel. Data was analyzed using SPSS software (version 16, SPSS Inc., Chicago, IL, USA) to obtain descriptive information. Then, we used IBM SPSS AMOS software (version 21, IBM Corp., North Castle, NY, USA) to analyze the structural equation.

Results

According to obtained demographic information, the mean age of participants was 46.25 ± 16.08 years. Most of them were women and in terms of marital status were married. The demographic characteristics of type 2 diabetics are presented in table 1.

Results of structural equation modeling (SEM) showed that, in general, data from this study had enough fitting for the model used. Measures of

goodness of fit are presented in table 2.

To determine the relationship between the structures examined in this study and predictive power of following a suitable diet we used the statistical analysis shown in figure 1. Generally, 42% of changes in behavioral intention were expressed by the model. Perceived behavioral control, perceived risk, and subjective norm with impact factors of 0.3, 0.22, and 0.2, respectively, had significant statistical correlation. This means that patients, who better controlled their nutritional behavior, gave more thought to the risk of developing diabetic complications, and were also affected by their relatives, had greater behavioral intention to adhere to a healthy diet. Behavioral intention expressed 16% of behavioral changes. The only structure which had no significant statistical correlation with behavioral intention was attitude. According to the results, the strongest predictor for behavioral intention to follow a healthy diet was the structure of perceived behavioral control.

Discussion

Based on medical literature, there is no absolute cure for diabetes.[20] Thus, controlling and preventing complications of diabetes is important.[21] The best way to control diabetes is by keeping the blood sugar level in the normal range.[22] This depends on maintaining a healthy diet which is suitable for these patients.[21] The aim of this study was to detect psychological factors effective on maintaining a healthy diet for diabetes and effective behavioral intervention using TPB and perceived risk structure.

Table 1. Demographic characteristics of patients

Variables	n (%)	Mean ± SD
Sex		
Men	63 (40.8)	
Women	91 (59.2)	
Marital status		
Single	18 (11.8)	
Married	111 (72.1)	
Divorced	7 (4.4)	
Widowed	18 (11.8)	
Education		
Illiterate	5 (3.3)	
Primary school education	25 (16.4)	
Pre-diploma education	25 (16.4)	
Diploma	43 (27.9)	
Above diploma education	33 (21.3)	
Bachelor's degree or higher	33 (14.8)	
Structure		
Perceived attitude		93.62 ±36.7
Perceived behavioral control		77.54 ± 29.8
Perceived Subjective norm		55.96 ± 24.3
Perceived risk		8.32 ± 2.2
intention		7.22 ± 0.9
Behavior toward a healthy diet		22.40 ± 4.5

SD: Standard division

Table 2. Measures of goodness of fit

Chi-square	DF	CFI	GFI	AGFI	RMSEA
3.22	77.00	0.85	0.92	0.90	0.07

DF: Degree of freedom; CFI: Comparative fitness index; GFI: Goodness of fit index; AGFI: Adjusted goodness of fit index; RMSEA: Root mean square error of approximation
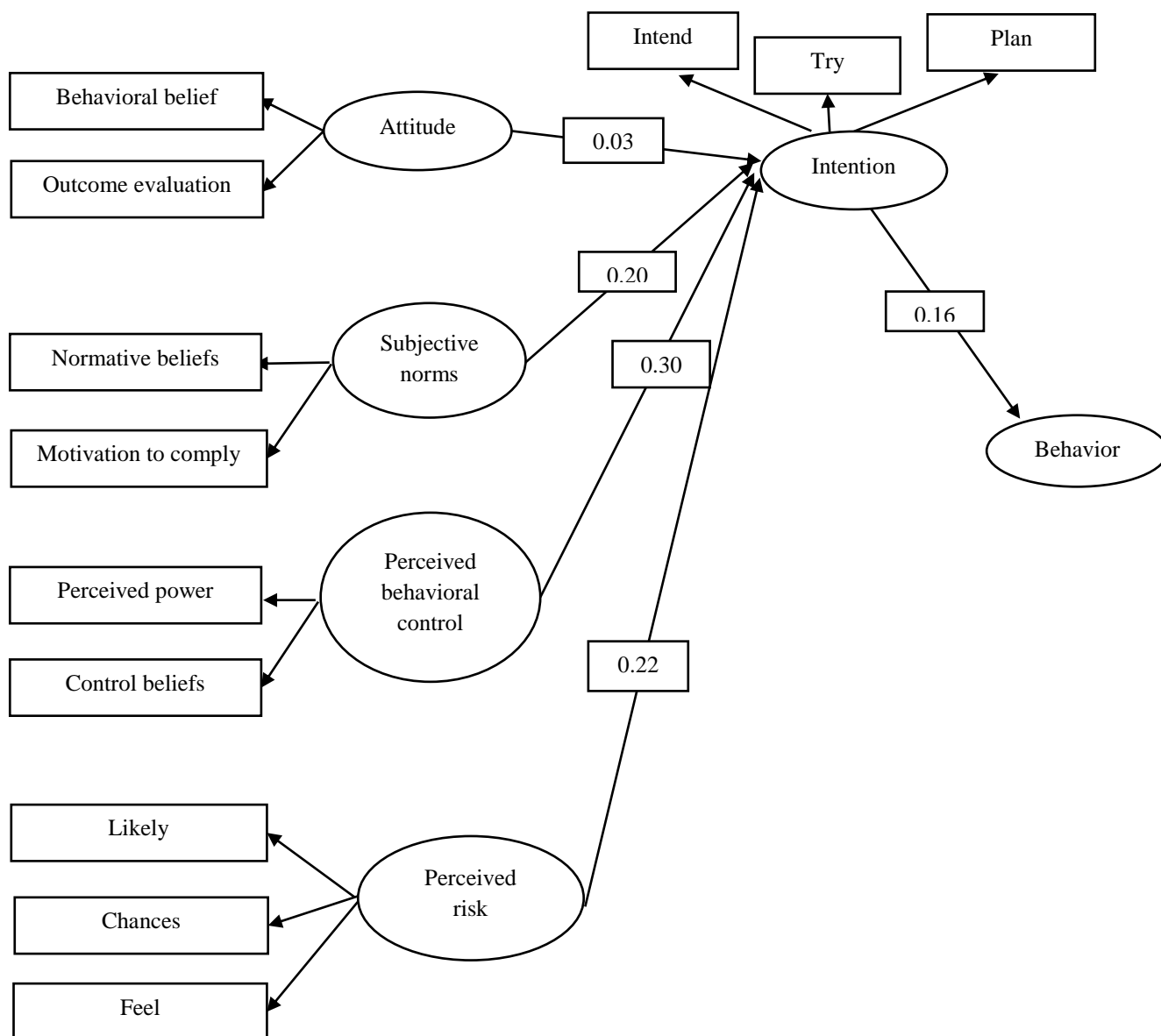
Figure 1. Structural equation modeling

Based on the mean score obtained in this study and its comparison with previous studies in Iran and other countries[22-25], we can conclude that diabetics followed unhealthy diets. This was a predictable issue. Based on this matter, nutritional behaviors of diabetics can be improved by TPB.[26,27]

According to concepts of planned behavior, the best predictor variable for behavior is behavioral intention. We can identify factors effective on behavior by identifying factors affective on behavioral intention. Based on this study, perceived behavioral control structure had the greatest impact on behavioral intention. This result is in agreement with that of some previous studies. For example, the results of the study by Blue on beliefs associated with a healthy diet conducted on 106 diabetics in the USA in 2006 were in agreement with those of the present study.[2] Recent studies conducted on nutritional behavior among healthy subjects using TPB

showed contradictory results. For example, the results of the study by Dehdari et al.[28] that was performed in 2012 to assess nutritional behaviors in female students showed that the structure of perceived behavioral control was not the strongest predictor for behavioral intention. The reason for this inconsistency with previous studies on healthy subjects may have been the experience of regular behaviors in diabetics such as timely use of drugs or diabetic foot examination. By the continuation of these behaviors, patients' power, control, and confidence increased.

Based on our results, attitude toward a healthy diet had minimal impact on behavioral intention in patients. This finding is contradictory to that of some other studies. For example, Omondi et al. conducted a study in Kenia in 2010 to detect beliefs related to healthy diet with the developmental approach using TPB.[26] They concluded that attitude toward a healthy diet was the strongest predictor for behavioral intention. One reason for this inconsistency was weakness and lack of attractiveness of our health messages about healthy diet that was weak in terms of the ability to become behavioral intention in the society especially among diabetics. Another reason may be the influence of the patients' relatives on them that is our cultural characteristic. The findings of our study indicated that subjective norms had more effect on changes in behavioral intention than attitude; thus, politicians and health care personnel can use this to change attitudes and behaviors of individuals especially diabetics.

Various studies have successfully used structure of perceived risk to create behavioral intention related to nutritional behaviors.[2,28-30] Therefore, in this study, we added this structure to the model to increase its predictive power. Our findings showed that the structure of perceived risk of diabetic complication affected patients' behavioral intention. This was in agreement with the results of other studies.[2,31] Accordingly, perceived risk can be replaced by attitude in educational and behavioral interventions.

In our study, the studied structures were good predictors for patients' intention and behavior. Based on the study by Armitage and Conner,[32] behavioral intention was the main cause of behavior. In recent studies, researchers have suggested adding other variables to behavioral intention to increase its predictive power. For example, Schwarzer et al. reported that planning for action and self-overcoming of obstacles decreased the gap between intention and real behavior.[33] Accordingly, additional studies are needed to detect mediator variables. The limitations of the present study were that we did not measure behavioral intention and behavior at two distinct time points because of administrative constraints, which are recommended to be considered in future studies.

Conclusion

The TPB and perceived risk structure can be used as a good model to conduct an effective intervention in providing a healthy diet for diabetes. Perceived behavioral control structure had more effect on behavior than other structures in diabetics. Therefore, it should be taken into consideration in nutritional behavior interventions in diabetics. On the other hand, researchers should consider other structures such as perceived risk which can increase predictive power of the models applied in the health intervention.

Recommendations

There is a lack of an integrated and systematic training program at the national level in the field of prevention of diabetes and its complications. Due to this and the positive results obtained in this study, we recommend more researches to identify beliefs about diet in diabetic patients in Iran and the world. It is hoped that through these studies a better

vision can be achieved in this respect in the country and more effective interventions at a national level can be implemented.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

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