Evaluation of the Intention of Nutritional Behavior in Women with Prediabetes Based On the Theory of Planned Behavior

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A R T I C L E I N F O	**A B S T R A C T**
Article type: Research Paper	**Introduction:** Diabetes is one of the most common non-communicable diseases that can be prevented and controlled by following a healthy lifestyle. This study aimed to apply the theory of planned behavior in determining the predictors of nutritional behavior in women with prediabetes referred to the comprehensive health service centers of Mashhad University of Medical Sciences.
	Methods: This descriptive-analytical study was conducted in 2020. A total of 196 pre-diabetic women referred to Mashhad Comprehensive Health Service Center (Iran) were selected by multi-stage random sampling. To collect the data, a researcher-made questionnaire including demographic information based on the theoretical structures of planned behavior [attitude, subjective norms, behavioral control, and intention to follow a healthy diet] was used. Data were analyzed in SPSS-25 software at a significance level of 0.05.
	Results: The mean of total scores obtained in Attitude constructs 4.1 ± 0.50, subjective norms 3.67 ± 1.06, perceived behavioral control 4.13 ± 0.55 and behavioral intention 4.00 ± 0.39 and healthy eating behavior 3.00 ± 0.65 was reported. The construct of the subjective norm (β = 0.254) was a strong predictor in the structure of intention and intention (β = 0.419) and perceived behavioral control (β = 0.240) was a strong predictor of nutritional behavior (p <0.001). Planned behavior theory was able to predict 40.5% of eating behavior in women with prediabetes.

Conclusion: It seems that by applying the planned theory in the design of educational programs, it is possible to improve the observance of a healthy diet in women with prediabetes. |

Introduction

The incidence and prevalence of diabetes have been increasing rapidly in the last century. More than 7 million people worldwide are diagnosed with diabetes each year, with 3.8 million deaths from diabetes occurring, meaning one death from diabetes every 10 seconds (1). The prevalence of diabetes in the Middle East will increase significantly by 2030, and it is estimated that the annual growth rate of diabetes in Iran by 2030 will be the highest-second in the region after Pakistan (2). According to the latest reports of the World Health Organization in 2016, the prevalence of this disease in Iran is 9.6% for men and 11.1% for women (3).

The hereditary background and environmental factors are necessary for the development of type 2 diabetes, which is the most common type of

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diabetes. In many cases, poor nutrition and a sedentary lifestyle lead to pre-diabetes and then overt diabetes. Prediabetes is defined as a disease in which fasting glucose in patients with between 100 and 125 mg/dL and a two-hour glucose tolerance test between 140 and 199 mg/dL [4].

In epidemiological studies conducted in Mashhad in 2018, Isfahan in 2013, and Ahvaz in 2014, the prevalence of pre-diabetes was 15, 19.5, and 18.3%, respectively. These statistics show the high prevalence of pre-diabetes, which in all cases Prediabetes was more common in women [5-7].

90% of people with pre-diabetes are unaware that they have the disease, and about 30% of these people will develop type 2 diabetes [8]. This stage can be important and sensitive in the development of diabetes because it is detectable and its treatment may be effective in preventing or delaying diabetes [9]. Studies have shown that by modifying the pre-diabetes stage through lifestyle modification, the chance of developing type 2 diabetes in people with pre-diabetes can be reduced by up to 60% [10]. The Progressive Importance of Type 2 Diabetes and Its Chronic Complications Provide complex conditions that require lifestyle modification interventions to prevent and control type 2 diabetes, and lifestyle modification is the cornerstone of type 2 diabetes control. Therefore, the need for intervention in the pre-infection stage, and creating a low-cost strategy to prevent it is felt more than ever [5, 11].

The theory of planned behavior consists of structures of attitude (a person's cognitive and affective evaluation of a healthy behavior such as nutritional behavior as being good for them to manage their Diabetes prevention);), subjective norms (the important people in a person's life who encourage the person to perform healthy behaviors, such as my spouse would like me to Have a healthy diet to prevent diabetes and perceived behavioral control (The confidence or capability to perform a healthy behavior, such as 'I am to Have a healthy diet to prevent diabetes.'), which are effective on behavioral intention [12]. The more favorable a person's attitude towards a behavior is, the more others approve of doing that behavior, and the more control a person feels over performing a behavior, the more it affects the intention and the more likely the person is to perform that behavior [13].

This theory has been used in many studies, including: in explaining the adoption of healthy eating behavior in type 2 diabetic patients [14], performing self-care behaviors in type 2 diabetic patients [15], as well as physical activity and drug adherence in patients with type 2 diabetes. [16]. Systematic review studies show the need for formative research to investigate the effect of the structures of the theory of planned behavior on the intention and adoption of nutritional behavior [17, 18]. Diabetes has not been reported in Iran and considering that the statistics show a high prevalence of pre-diabetes in women, to evaluate the status of nutritional behavior and improve nutritional behavior in the prevention of pre-diabetes to diabetes, effective social factors should be identified. Therefore, the present study aimed to apply the theory of planned behavior in determining the predictors of nutritional behavior in women with prediabetes in comprehensive health centers in Mashhad.

Materials and Methods

This cross-sectional descriptive-analytical study was conducted in 2020. The statistical population was women with prediabetes referred to Mashhad Comprehensive Health Service Centers who had health records.

Due to the lack of a completely similar study in Iran, the sample size was determined using the effect size formula and taking into account 5% error, test power 80%, and effect size 0.2, using the formula below 196 people.

$$n = \left(\frac{z_{1-\frac{\alpha}{2}} + z_{1-\beta}}{\frac{1}{2} ln \frac{1+r}{1-r}}\right)^2 + 3 = \left(\frac{1.96 + 0.84}{\frac{1}{2} ln \frac{1+r}{1-r}}\right)^2 + 3 = 196$$

In this study, a multi-stage sampling method was used to examine women with prediabetes, so that out of three health centers in Mashhad, three centers were selected by simple random as the main cluster. Following that, four comprehensive health service centers from each of the above health centers were selected by simple randomness (12 comprehensive health service centers in total were reviewed).

Finally, from each comprehensive health service center about the population of people with prediabetes, the number of people with prediabetes was selected from the list. Patients covered by comprehensive health service centers were selected by simple random sampling using a random number table.

Inclusion criteria included informed consent, willingness to participate in the study, women with pre-diabetes (with a diagnosis of blood sugar level 125-100), the age range of 30-59 years, no other chronic diseases and debilitating problems (Such as cancer, psychological problems, and high blood pressure, etc.), was at least the fifth elementary education and Iranian nationality. Individuals who had completed the questionnaires incompletely and were unwilling to cooperate during the study were excluded from the study.

Data were collected after obtaining the necessary permits from the Vice-Chancellor for Health of Mashhad University of Medical Sciences to complete the questionnaires.

Due to the prevalence of coronavirus and the limited number of patients referred to comprehensive health care centers in person, the questionnaires were completed by telephone. Thus, after justifying the study and stating the goals, and ensuring the confidentiality of the information and with their consent, it was completed within 15-20 minutes for each person. Individuals who were unable to respond by telephone were completed in person at the Comprehensive Health Services Center.

The tool for measuring the study variables was a researcher-made questionnaire that was developed based on the study of scientific sources and the opinions of professors in the Department of Nutrition and Health. After preparing the questionnaire, the face and content validity method was used to determine validity.

The questionnaire consisted of two parts, the first part contains personal characteristics such as age, body mass index, marital status, education, job, family income, disease, family history of diabetes and the second part is related to questions the constructs of the theory of planned behavior consisted of 16 questions. To construct the attitude, 6 questions were used. For example, "I think pre-diabetes is not a serious problem and will improve without any specific action" and "I think diabetes is completely inherited and nutrition has no role in preventing it." To measure the structure of the subjective norm, ask 2 questions: "The doctor encourages me to follow a healthy diet (including daily consumption of fruits and vegetables, milk and dairy products, not eating fatty and sweet foods, fast foods, etc.)" and " The staff of the health center encouraged me to follow a healthy diet

(including daily consumption of fruits and vegetables, milk and dairy products, not consuming fatty and sweet foods, fast foods, etc.). Two questions were used to measure the perceived behavioral control structure, for example, "It is entirely up to me to decide whether to eat fatty foods." 3 questions were used to measure intentional behavior. For example, "I plan to eat less unhealthy foods (fast foods, soft drinks, sugary drinks, cakes, and chocolates, etc.) in the next month", all of which are on a Likert scale with a range of 1 (strongly disagree) It was up to 5 (strongly agree). Three questions related to the structure of behavior were assessed based on a five-point Likert scale from 1 (never) to 5 (always). For example, "I eat at least 2 servings of fruit a day."

Questionnaire scores ranged from 16 to 80, with higher scores indicating higher behavior in preventive nutrition than diabetes. To determine the face validity index in this study, the views of a panel of ten experts including two nutritionists and eight health education experts were used and their suggestions for correcting the questionnaire items were taken into account. The content validity of the questionnaire was calculated by calculating the content validity index (CVI) and content validity ratio (CVR), which were 0.89 and 0.90 for the whole questionnaire, respectively. The reliability of the instrument was assessed by calculating internal consistency and stability by calculating Cronbach's alpha and the interclass correlation coefficient between test and retest (ICC), respectively. Cronbach's alpha results were calculated to assess internal consistency for attitude structure of 0.730, subjective norms of 0.958, perceived behavioral control of 0.745, the intention of the behavior of 0.736, behavior of 0.722, and the whole questionnaire of 0.748. Intra-class correlation coefficient (ICC) was calculated for attitude 0.868, subjective norm 0.916, perceived behavioral control 0.942, intention behavior 0.960, behavior 0.948, and the whole questionnaire 0.925.

Height was measured using a tape measure fixed on the wall, standing and without shoes, and weight with minimal coverage and without shoes was measured using a digital scale.

Data were entered into SPSS statistical software version 25 and using descriptive statistics, indices of a tendency to center and dispersion such as mean and standard deviation of values

related to quantitative variables and determination and frequency distribution and percentage of qualitative variables were determined. Linear regression was used to determine the structures that had a more predictive effect on the nutritional behavior of women with prediabetes. The significance level in this study was considered 0.05. This article is taken from a research project with the ethics code IR.MUMS.REC.1399.324.

Table 1. Demographic information of the participants in the study marital status

variable		N	%
Marital status	Single	1	0.5
	Married	169	86.2
	divorced	10	5.1
	Deceased wife	16	8.2
Level of Educational	High school	113	57.7
	Diploma and above	83	42.3
Marital status	housewife	188	95.9
	Employed	6	3.1
	Retired	2	1.0
Household income	Less than enough	134	68.4
	Enough	61	31.1
	More than enough	1	0.5
Family history of diabetes	yes	70	35.7
	no	126	64.3

Table 2. Descriptive statistics for and inter correlations among variables attitudes, subjective norms, perceived behavioral control (PBC), Intention and Behavior.

Variable	Correlations					Means± SD	Range Max,Min
	1	2	3	4	5		
1.Attitude	-	-	-	-	-	4.01±0.50	5.00,2.83
2.Subjective Norms	0.109	-	-	-	-	3.67±1.06	5.00,0.00
3.Perceived behavioral control	0.226**	0.273**	-	-	-	4.13±0.55	5.00,2.00
4.Intention	0.145*	0.372**	0.506**	-	-	4.00±0.39	5.00,3.00
5.Behavior	0.075	0.051	0.302**	0.341**	-	3.00±0.65	5.00,1.67

* Correlation is significant at p <0 .05, ** Correlation is significant at p <0 .01

Results

The mean age of study participants was 47.41 ± 7.01. 36.7% (n = 72) were overweight and 49.5% (n = 97) were obese and 13.8% (n = 27) had normal body mass index. Table 1 shows the other demographic information of the study participants.

The mean standard deviation of the scores of the structural model of the theory of planned behavior and nutritional behaviors preventing type 2 diabetes in women with prediabetes is shown in Table 2. Among the model constructs, perceived behavioral control had the highest and behavior had the lowest mean percentage of the highest score.

The correlations between the structures of the theory of planned behavior and nutritional behavior in women with pre-diabetes are shown in Table 2.

The results show that there was a direct and significant correlation between the scores of perceived behavioral control structures and intention and behavior. Also, the results in Table 2 show that there was no direct correlation between the scores of attitude structures and subjective norm with behavior and it was not statistically significant.

Table 3. Simple linear regression results in predicting the intention of nutritional behavior based on the structures of the theory of planned behavior

Variable	Non-Standard Coefficient (Standard Deviation)	Standardized Coefficient	P-Value	R2
Attitude	0.133(0.046)	0.195	0.005	
Subjective Norms	0.184(0.048)	0.254	<0.001	0.212
Perceived behavioral control	0.191(0.066)	0.206	0.004	

Table 4. Linear regression results in predicting nutritional behavior based on the structures of the theory of planned behavior

Variable	Non-Standard Coefficient (Standard Deviation)	Standardized Coefficient	P-Value	R2
Attitude	0.147(0.055)	0.159	0.009	
Subjective Norms	0.031(0.059)	0.031	0.605	0.405
Perceived behavioral control	0.300(0.079)	0.240	<0.001	
Intention	0.564(0.085)	0.419	<0.001	

The findings of Table 3 show that the structure of subjective norms has the strongest power in predicting the intention of nutritional behavior in women with prediabetes. According to the results of the constructs of subjective norms, perceived behavioral control and attitude were able to predict 21.2% of changes in behavioral intention.

The findings of Table 4 show that the strongest construct in predicting nutritional behavior in women with prediabetes was intentional structure and was able to predict 41.9% of behavior changes; after that, the perceived behavioral control construct could predict 24% of behavior changes and then the attitude construct could predict 15% of behavioral changes. The lowest power of structures in predicting nutritional behavior was related to the structure of subjective norms. Also, the findings of the study showed that the predictive power of nutritional behavior of all structures was 40.5%.

Discussion

In this study, social cognitive predictors of nutritional behavior in women with prediabetes were determined based on the theory of planned behavior. As it is clear from the results, the highest correlation between the constructs of the theory of planned behavior and the nutritional behavior was related to the structure of perceived behavioral control and intention of behavior, and the weakest correlation was related to subjective norms and attitudes. Among the constructs of the theory of planned behavior, perceived behavioral control showed the highest correlation with behavioral intention, and intention had the highest correlation with nutritional behavior. Consistent with these findings, the results reported from the Satisfaction Study of Rezabeigi et al. In 2018 show that perceived behavioral control had the highest correlation with behavioral intention, and construct intention had the highest correlation with nutritional behavior [19].

In Close et al. study in 2018, the effect of perceived behavioral control on intention was the strongest [20]. The results of the study by White et al. In 2012 also showed the highest correlation between perceived behavioral control and intention, and perceived intent and behavioral control were a strong predictor for the consumption of saturated fat foods in the subjects [21]. Also, in Mazloomy et al. study in 2018, the perceived behavior control construct showed the highest correlation with weight loss intention and behavior, and the highest correlation of planned behavior theory constructs with weight loss behavior was related to perceived behavioral control structure and behavioral intention. And the weakest predictive power was reported for subjective norms and attitudes [22]. In the results of the study of Bagheri et al. In 2019, which was conducted to determine the factors affecting healthy eating behaviors in diabetic patients, the structures of the theory of planned behavior had a suitable fit. Findings of this researcher's study showed that perceived behavioral control structures, subjective norms and attitudes had a significant relationship with the intention to follow a healthy diet and the theory of planned behavior was a good predictor of the intention to follow a healthy diet in diabetic patients. [23].

The findings of the present study show that the constructs of attitude, subjective norm, and perceived behavioral control predict a total of 21.2% of the variance of intention. In this study, in general, the structures of the theory of planned behavior were able to predict 40.5% of nutritional behavior. According to studies, various factors can affect a particular behavior, including socio-economic factors, socio-cultural norms, and family characteristics that can affect nutritional behavior [24]. Consistent with these findings, the ability to predict nutritional behavior in the study of satisfaction of judges and colleagues was 44% [19]. Also in Babazadeh et al. study in 2015 on the predictors of fruit and vegetable consumption in students using the theory of planned behavior, model structures

were able to predict 39% of changes in fruit and vegetable consumption [25]. In Sadat Navabi et al. stud, regarding the prediction of weight loss behavior, the variables of attitude, subjective norms, perceived behavioral control and intention predicted a total of 44% of the behavior [26]. In Peyman et al. study in 2015 on the consumption of prepared foods in students, the results showed that the constructs of attitude, subjective norm, and perceived behavioral control together predicted 56.5% of intentional behavior and 20.32% of behavior [27]. The reason for the difference in the results of these studies may be due to differences in the study group, the type of behavior studied, and the research environment and data collection tools.

Based on the findings of the present study on the effect of attitudes of women with prediabetes on having nutritional behaviors that prevent type 2 diabetes, the results showed that attitudes were significantly associated with the intention of eating behaviors, although this relationship was not very strong. Contrary to these findings, in the study of Hossein Rouhani et al., Attitude had no significant relationship with the behavioral intention [14].

The findings of our study showed that the determining role of subjective norms of women with prediabetes is important in the intention of nutritional behavior but does not play an important role in following their eating behavior and women's attitude has a more important effect on following behavioral norms than subjective norms. . Subjective norms reflect a person's perception of whether or not others approve of a behavior. In this study, the influential people on the intention to perform the behavior of women with prediabetes, physicians, and staff of comprehensive health services. Therefore, the greater the supportive and facilitative role of abstract norms, the more likely it is that these individuals will intend to behave correctly. Similarly, the results of a systematic review and meta-analysis show that subjective norms are the most important determinants of nutritional intent and behavior [18]. Contrary to these findings, another study reported that subjective norms have a more significant effect on individuals' attitudes toward adhering to eating behavior [28].

In this study, perceived behavioral control after the intention was the most important determinant of diabetic preventive eating behavior. Perceived behavioral control reflects a person's beliefs about the availability or non-availability of resources and opportunities to engage in the behavior. People are motivated to engage in healthy behaviors when they feel they have control over that behavior [29]. In studies related to nutrition education, the role of perceived behavioral control as a predictor of nutrition-related intention and behavior has been highly emphasized [30]. Contrary to the present findings, the results of Malik et al.'s study in 2017 showed that perceived behavioral control structures and subjective norms were the most important factors determining the intention and adherence to healthy eating behaviors in pregnant women [26]. This discrepancy in study findings may be due to differences in the characteristics of study target groups and study tools.

According to the results, the intention was a strong predictor of behavior. Behavioral intention is the thought of performing a behavior that is the immediate determining factor of a specific behavior. High Predictability of Intention in this Study, was consistent with the Results of the Rezabeigi et al. Study(2018) Aiming at Factors Affecting Nutritional Behavior Related to Heart Disease [19] and Bagheri et al. Study(2019) Aiming to Investigate Healthy Eating Behavior in Diabetic Patients that intended was a strong predictor of behavior [23]. It seems that by promoting perceived behavioral control and intention, we can help increase the nutritional performance of preventing type 2 diabetes in women with prediabetes.

To our knowledge, the lack of a similar study in the field of application of the theory of planned behavior to predict nutritional behavior in pre-diabetic individuals is the strength of the study. One of the limitations of this study is the small sample size and considering that the present study was conducted only on women, so the results cannot be generalized to other age and sex groups and it is recommended that future studies be conducted in this field.

The present study is a cross-sectional study and it was not possible to analyze the causal relationships due to the nature of the study. The self-report of the questionnaire used and the researcher's lack of control over the accuracy of the report can cause bias. Also, the effect of individual differences and personality traits of individuals, the level of interest of individuals

when answering questions was beyond the control of the researcher. Another limitation of the present study was the selection of research samples from patients covered by Mashhad Comprehensive Health Service Centers, which certainly limits the generalization of the study results due to the cultural and economic context and demographic characteristics. Therefore, similar studies are recommended in other cities.

Conclusion

Considering that in the present study, the construct of perceived intention and perceived behavioral control was a good predictor of food behavior, by strengthening these structures, an effective step can be taken to improve nutritional behavior. Subjective norms were also the strongest structure affecting intention, so it seems that providing educational programs through the staff of comprehensive health service centers has an impact on behavioral intention and it is suggested when designing interventions to improve nutritional behaviors to prevent type 2 diabetes. Influential social cognitive factors should be considered.

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Conflicts of Interest
None declared

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