

## Factors Influencing Physical Activity Behavior among Iranian Women with Type 2 Diabetes Using the Extended Theory of Reasoned Action

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**Background:** Findings of most studies indicate that the only way to control diabetes and prevent its debilitating effects is through the continuous performance of self-care behaviors. Physical activity is a non-pharmacological method of diabetes treatment and because of its positive effects on diabetic patients, it is being increasingly considered by researchers and practitioners. This study aimed at determining factors influencing physical activity among diabetic women in Iran, using the extended theory of reasoned action in Iran.

**Methods:** A sample of 352 women with type 2 diabetes, referring to a Diabetes Clinic in Khoy, Iran, participated in the study. Appropriate instruments were designed to measure the desired variables (knowledge of diabetes, personal beliefs, subjective norms, perceived self-efficacy, behavioral intention and physical activity behavior). The reliability and validity of the instruments were examined and approved. Statistical analyses of the study were conducted by inferential statistical techniques (independent *t*-test, correlations and regressions) using the SPSS package.

**Results:** The findings of this investigation indicated that among the constructs of the model, self efficacy was the strongest predictor of intentions among women with type 2 diabetes and both directly and indirectly affected physical activity. In addition to self efficacy, diabetic patients' physical activity also was influenced by other variables of the model and sociodemographic factors.

**Conclusion:** Our findings suggest that the high ability of the theory of reasoned action extended by self-efficacy in forecasting and explaining physical activity can be a base for educational intervention. Educational interventions based on the proposed model are necessary for improving diabetics' physical activity behavior and controlling disease.

**Keywords:** Diabetes mellitus; Motor activity; Self efficacy; Theory of reasoned action

### INTRODUCTION

Diabetes is one of the most serious chronic diseases in the worldwide. There were estimated to be 285 million adults with diabetes in 2010 of which 90 to 95 percent had type 2 diabetes.

This number will continue to increase globally due to an aging population, population growth, urbanization and the high prevalence of obesity and sedentary lifestyles [1]. Iran is one of the Middle Eastern countries that have been affected by this condition. Considering Iran's growing elderly population, a

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rapid increase in the prevalence of this disease is expected. It has been reported that 2% of Iran's population has diabetes and the prevalence of diagnosed diabetes for those over the age of 30 years is estimated to be 7.3% [2]. In addition, this problem is affecting even younger age groups, increasingly striking young adults and even adolescents [3]. Controlling blood sugar levels and maintaining them in an optimal range is essential for disease control and prevention of the debilitating complications [3,4]. To achieve this goal, it is necessary for patients to comply with diabetes treatment methods such as taking recommended diabetes medications, lifestyle changes, regular exercise and regular blood glucose monitoring [5].

Regular physical activity is one of the most important factors for creating, maintaining and improving health. It has also been emphasized as one of the 15 priorities for improving health [6]. Physical activity plays a key role in the management of type 2 diabetes and glycemic control [7]. Physical activity reduces insulin resistance [8]; decreases blood sugar; increases the number of receptors and sensitivity of cells to insulin concentration in tissue; diminishes fat tissue, weight and blood pressure; increases physical fitness and can aid in both prevention and management of 2 type diabetes [9]. Despite the positive effects of physical activity on different dimensions of diabetics' health, most diabetic patients have low levels of mobility compared with non-diabetic individuals (34% vs. 40%, respectively) [10]. Diabetic women's participation in physical activity is very low and is often further reduced with increasing age. Only 14 to 16 percent of women aged 45 to 75 years participate in recommended levels of physical activity [11].

Low levels of physical activity in diabetic patients may be a function of individual, social and psychological factors. Understanding and identifying those factors aids health services providers designing appropriate interventions for promoting physical activity behavior among diabetics. Due to difficulties in creating and maintaining physical activity behavior and its complexity, the use of behavior change theories and models is necessary [12]. These theories and models identify factors affecting targeted behaviors and determine the relationships of these factors with the given behavior [13].

Since the earliest days of the theory of planned behavior (TPB), there has been a degree of uncertainty concerning the relationship between Ajzen's perceived behavioral control and Bandura's self-efficacy construct. Both constructs concern control over the execution of a behavior: the perceived ease and difficulty of performing a behavior (perceived behavioral con-

trol, PBC) and the belief that one is capable of performing the behavior (self-efficacy) [14,15]. Additionally, congruent with Ajzen's argument that self efficacy and PBC are synonymous, several researchers have incorporated measures of self-efficacy within the TPB framework. Nevertheless, Ajzen and Madden's (1986) and Ajzen's (1991) description of the relationship between PBC and behavior as a proxy of control and a reflection of skills and ability suggests the existence of two separate processes of control. The first is related to Bandura's self-efficacy construct (1977), the second to perceived controllability of the behaviors.

In 1977, Armitage and Conner suggest the existence of two processes of control, internal and external, discriminable but not independent of each other. According to these authors, being very confident of one's abilities to perform a behavior may lead to underestimation of external control; likewise, the presence of external facilitating conditions may boost self-efficacy perceptions. The lack of clarity in the conceptual and operational definitions of PBC and self-efficacy within TPB research makes it problematic to draw conclusions about which could be the most appropriate construct in this framework. Furthermore, the existence of overlap between the constructs among these theories made it difficult to compare them.

On the other hand, consistent across many studies, there is a strong relationship between self-efficacy and intention [16,17]. People are more likely to intend a behavior when they feel they are able to perform it. Also, several studies have suggested strong relationships between self-efficacy and health behavior [17]. Recent studies have reported an association between self-efficacy and adherence to physical activity behavior in diabetics [18]. On the basis of the above documents and the lack of clarity in the conceptual and operational definition of the PBC construct within the TPB framework, we decided to design and test a new version of the theory of reasoned action (TRA) in order to identify predictors of physical activity behavior among Iranian women with type 2 diabetes.

TRA, one of the most successful theories of behavior change, has demonstrated its efficiency in predicting and determining various health behaviors.

This theory claims that the intention to perform a behavior is explained by an incorporation of attitudes and subjective norms. Attitudes including belief in a particular behavior lead to certain outcomes and subjective norms contain social pressures that one receives from others for engaging in a given behavior. Intentional behavior is then considered to be a func-

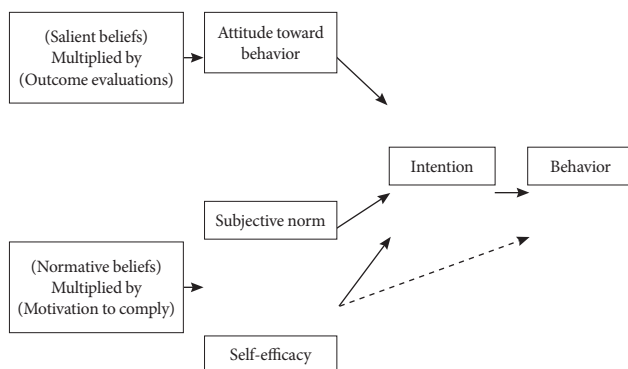
tion of one's intentions, which are a reflection of attitudes toward the behavior and the perceived social norms [19].

Since behaviors that are not fully volitional are also influenced by the individual's perception of his or her ability to perform the behavior, the TRA would not be sufficient to examine the relationships of health beliefs with the intention to perform physical activity in diabetic patients. To account for this, the TRA has been further developed by adding several constructs that involve perceptions of control over behavior.

This study proposed an extension of the TRA that includes self-efficacy as a third determinant of behavioral intention, in addition to the subjective norm and attitude toward the behavior constructs proposed in the original theory (Fig. 1). Self-efficacy beliefs reflect people's thoughts about their capability to perform certain behaviors and influence the activities that individuals choose to approach as well as their motivation and persistence in presence of obstacles [20].

Our theoretical framework postulates that self-efficacy may also directly affect physical activity behavior (represented by the broken line in Fig. 1). The theoretical base of this relation is supported by Bandura's assertion that, besides the motivational component of self-efficacy, highly efficacious people are more likely to persevere in their attempts in performing a behavior in situations presenting barriers to performance attainment, while inefficacious individuals tend to give up quickly [20].

According to the proposed model, diabetic patients will intend to adhere to physical activity if they believe that such adherence will be associated with more positive outcomes than negative outcomes, and if they believe that referents with whom they are motivated to comply (physicians, spouse, family, and friends) think that they should try to adhere to such behaviors.



**Fig. 1.** The extended theory of reasoned action applied to physical activity behavior.

Individuals will succeed in their attempts if they have sufficient self-efficacy to master the tasks or successfully execute the behaviors required to produce the expected outcome.

In present research, the purpose of the investigation was to test a composite model, namely the extended theory of reasoned action, by adding a self-efficacy construct to understand and predict physical activity behavior in Iranian women with type 2 diabetes. It is hoped that this might contribute to existing knowledge and help to enhance women's health.

## METHODS

The current study is a cross-sectional survey designed to examine and understand factors that influence the adherence to physical activity behavior among Iranian women with type 2 diabetes.

A sample consisting of 352 women with type 2 diabetes referring to the Diabetic Clinic in Khoy, Iran was recruited for the current research. Inclusion criteria for the study participation were women: 1) diagnosed with type 2 diabetes, 2) living in Khoy, Iran, 3) aged between 18 to 65 years, and 4) having been diagnosed as diabetic patients for at least 6 months. Participants with gestational diabetes, ulcers on their feet or progressive cardiovascular conditions were excluded.

To collect data, we developed a self-administered questionnaire using two manuals related to constructing questionnaires based on the theory of planned behavior [21,22] and the scales of previous studies. This measurement instrument included seven subscales: sociodemographic characteristics (12 items), knowledge of diabetes (11 items), attitude toward behavior (4 items), subjective norms (4 items), self-efficacy (4 items), behavioral intention (2 items) and behavioral performance (2 items). Response categories for each item relating to the proposed model variables include a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and a 5-point Likert scale ranging from 1 (strongly unimportant) to 5 (strongly important).

Attitude toward physical activity was indirectly measured by a four-item scale comprising: two items related to behavioral beliefs and two items regarding the evaluation of behavioral outcomes.

Subjective norms concerning physical activity behavior were indirectly measured by a four-item scale including: two items related to normative beliefs and two items related to motivation to comply.

Self-efficacy toward physical activity was assessed using statements such as: "I am able to do physical activity every day," and "I think I'm able to take extra physical activities when the doctor advises me to do so," etc.

Behavioral Intention was measured with the following statements: "I intend to perform physical activity regularly within the coming month," and "I will plan to engage in extra physical activity three times per week if my doctor advises me to do so."

To assess levels of diabetes self-management, we used the Summary of Diabetes Self-Care Activities Measure [23]. Respondents reported the number of days they performed recommended physical activities over the past 7 days. Items from this scale assessed provider advice regarding physical activity adherence.

Knowledge of diabetes was assessed using 11 items. Each correct response was scored 2, and each "don't know" response, 0, with the response category ranging from 0 to 22. The subsequent results were based on the mean knowledge derived from 11 questions, each with a maximum point of 2 and a minimum point of 0.

To test clarity and content validity, the self-administered questionnaire was shown to a panel of experts consisting of five professors of health education, two nursing professors, one nutrition professor, one diabetes specialist, and one test designer. They evaluated each item for its distinctiveness, understandability, and appropriateness for the purpose of the study, and final revisions were made based on their comments. To evaluate reliability, instruments were completed by 352 diabetic patients and Cronbach's alpha for each of the questionnaires was calculated. Internal consistency of the knowledge questionnaire, including items related to diabetes care principles, methods of diabetes control and the importance of physical activity behavior was assessed and its Cronbach's alpha was 0.77. Similarly, the reliability of other surveys using internal consistency was studied and Cronbach's alpha values for attitude, subjective norms, self-efficacy, behavioral intention and physical activity behavior in the questionnaires were computed and confirmed (0.85, 0.83, 0.78, 0.92, and 0.95, respectively).

After assessing the psychometric characteristics of the instruments, the questionnaires were completed by study subjects. Since most participants were illiterate, or poorly educated, their questionnaires were filled out by trained and experienced interviewers. After collecting, organizing and classifying data with SPSS software version 16.0 (SPSS Inc., Chicago,

IL, USA), statistical analysis was performed using descriptive and inferential statistical methods (central indexes, *t*-test, correlation and regression). In this study, a *P* value of less than 0.05 was considered significant.

Before the study, an informed consent form was obtained from all of the participants and all ethical principles were considered in all phases of the research.

## RESULTS

### Characteristics of sample

Nearly 50.9% of the participants were between 44 to 56 years old. Slightly more than half of the research subjects (53%) were illiterate, 93.2% had no formal jobs outside of except house-keeping, and the remaining (6.8%) had part time jobs. About ninety-one percent of participants were currently married and approximately half of the women had a moderate monthly income. In this survey, most diabetic women were obese (40.1%) and overweight (46.9%). Most of the participants (62.2%) had diabetes for 1-10 years. Approximately three-fourths of subjects (74.4%) in this study were being treated by oral hypoglycemia agents, 22.2% of cases were using other therapeutic methods and the remaining participants (3.4%) were not receiving any treatment. Approximately two-thirds of the participants (63.1%) were visited by their physicians every 1 to 2 months, and the rest less frequently. According to the results of the present project, about 78.1% of the participants had not previously participated in any formal instructional meetings. The majority of subjects (72.4%) reported acquiring diabetes-related information from health professionals.

### Bivariate and multivariate analysis

The most important point in this study is that a factor is considered as predictor when it is significant both in bivariate analyses and in the final model of regression analysis. First, the Kolmogorov Smirnov statistical test was used to evaluate the normality of the study variables. According to findings of the above test (normal distribution of data), we utilized parametric tests for data analysis. The *t*-test and Pearson correlation coefficient indicated that there exists a significant difference between intention with regard to age, education level, income, resources of knowledge, knowledge level, attitude, subjective norms and self-efficacy ( $P < 0.05$ ). However behavior was influenced by education level, age, income, resources of knowledge, employment status, knowledge, attitude, self-efficacy,

**Table 1.** Univariate predictors of dependent variables of the proposed model in the current study ( $n=352$ )

Variables	Behavioral intention				Behavior			
	Mean	SD	Student's <i>t</i> -test	<i>P</i> value	Mean	SD	Student's <i>t</i> -test	<i>P</i> value
Sociodemographic variables education			$t=-4.57$	$0.001^b$			$t=-4.76$	$0.001^b$
Illiterate	3.6	0.86			0.7	1.0		
Literate	4.0	0.80			1.6	1.5		
Age			$t=2.24$	$0.02^a$			$t=2.37$	$0.01^a$
Lower than 43	4.0	0.87			1.3	1.7		
More than 43	3.7	0.85			0.9	1.2		
Family income			$t=-2.22$	$0.02^a$			$t=-2.28$	$0.02^a$
Lower than 500 dollars	3.8	0.85			0.1	1.3		
More than 500 dollars	4.1	0.89			1.6	1.8		
Resource of obtaining information regarding diabetes			$t=-2.96$	$0.003^b$			$t=-3.07$	$0.002^b$
Physician and diabetes clinic personnel	3.8	0.86			0.9	1.3		
Other resource	4.5	0.52			2.2	1.6		
Employment status			$t=1.65$	$0.10$			$t=3.29$	$0.001^b$
Employment	4.1	0.92			1.9	1.9		
Unemployment	3.8	0.85			0.9	1.3		

SD, standard deviation.  
<sup>a</sup> $P<0.05$ , <sup>b</sup> $P<0.01$  is significant.

**Table 2.** Results of correlation matrix between independent variables and dependent variables ( $n=352$ )

Variable	1	2	3	4	5	6
1. Diabetes knowledge	1					
2. Attitude toward physical activity	0.01 <sup>b</sup>	1				
3. Diabetes self-efficacy	0.08	0.39 <sup>b</sup>	1			
4. Subjective norms	0.02	0.40 <sup>b</sup>	0.24 <sup>b</sup>	1		
5. Behavioral intention	0.18 <sup>b</sup>	0.27 <sup>b</sup>	0.26 <sup>b</sup>	0.25 <sup>b</sup>	1	
6. Physical activity behavior	0.33 <sup>b</sup>	0.11 <sup>a</sup>	0.16 <sup>b</sup>	0.06	0.35 <sup>b</sup>	1

<sup>a</sup> $P<0.05$ , <sup>b</sup> $P<0.01$  is significant.

and behavioral intention ( $P<0.05$ ) (Tables 1 and 2).

In order to confirm the significance of the results of the bivariate analyses and explore real predictors, two models of regression analysis also were carried out on intention and behavior. In the first model, significant demographic variables in the bivariate analyses were entered into a multiple linear regression equation and their effect, as independent variables, on intention and behavior was evaluated. In the regression re-

lated to intention, only education level remained and the remaining variables were excluded from the regression equation and thereby the predictive ability of education level was confirmed ( $P<0.05$ ) (Table 3). However in the behavior-related regression analysis, knowledge and education level remained in the multiple linear regression equation and their influence was demonstrated ( $P<0.01$ ,  $P<0.05$ , respectively) (Table 4).

In the second model, significant demographic variables from the previous analyses, along with variables of the hypothesized model were entered into the regression equation and their effects on the main dependent variables (intention and behavior) were examined. In the final model, only education level along with attitude, subjective norms and self-efficacy remained in the regression equation and their impact was confirmed and maintained for behavioral intention ( $P<0.05$ ) (Table 3). However based on the results of final model of regression analysis related to behavior, variables such as knowledge, education level, self-efficacy and behavioral intention remained in the regression equation and their significant relationships to behavior were confirmed ( $P<0.05$ ) (Table 4).

**Table 3.** Results of multiple regression analysis on behavioral intention ( $n=352$ )

Independent variable	Beta	<i>t</i> -value	<i>P</i> value
Model 1			
Knowledge regarding diabetes	0.08	1.40	0.16
Education	0.22	3.63	0.001 <sup>b</sup>
Age	0.08	1.55	0.12
Family income	0.10	1.91	0.06
Resource of obtaining information about diabetes	-0.10	-1.78	0.08
Model 2			
Knowledge regarding diabetes	0.08	1.47	0.14
Education	0.13	2.14	0.02 <sup>a</sup>
Age	-0.04	-0.76	0.44
Family income	0.09	1.69	0.09
Resource of obtaining information about diabetes	-0.06	-1.05	0.29
Self-efficacy	0.25	4.29	0.001 <sup>b</sup>
Subjective norm (social pressure)	0.13	2.27	0.02 <sup>a</sup>
Attitude toward behavior	0.12	1.98	0.04 <sup>a</sup>

<sup>a</sup> $P < 0.05$ , <sup>b</sup> $P < 0.01$  is significant.

## DISCUSSION

Understanding and determining effective factors for influencing participation of diabetic patients in exercise programs based on behavior change theory, is essential and beneficial for health professionals. Unfortunately in Iran, health professionals do not care take behavior change theory into account when designing educational plans regarding diabetes and most of these plans are not successful. Since physical activity is a difficult and complex behavior and requires a variety of skills and competencies, the TRA is not sufficient for examining the relationship of health beliefs with intention to comply with physical activity in diabetic patients. As a result, the TRA has been extended by adding self-efficacy, which involves perceptions of control over behavior. This extended TRA seems more suitable for predicting factors effective for influencing physical activity in diabetics.

The current study revealed that self-efficacy is the strongest predictor of intention to perform physical activity and indirectly affects behavior ( $\beta = 0.246$ ,  $P < 0.01$ ). Intention to perform specific health behaviors is influenced by an individual's self-efficacy beliefs. The stronger diabetic patients' self-efficacy

**Table 4.** Results of multiple regression analysis on physical activity behavior ( $n=352$ )

Independent variable	Beta	<i>t</i> -value	<i>P</i> value
Model 1			
Knowledge regarding diabetes	0.25	4.27	0.001 <sup>b</sup>
Education	0.12	2.01	0.04 <sup>a</sup>
Age	0.02	0.34	0.74
Family income	0.01	1.83	0.07
Resource of obtaining information regarding diabetes	-0.07	-1.36	0.17
Employment status	0.09	1.54	0.12
Model 2			
Knowledge regarding diabetes	0.21	3.68	0.001 <sup>b</sup>
Education	0.11	2.02	0.03 <sup>a</sup>
Age	0.03	0.54	0.43
Family income	0.06	1.07	0.28
Resource of obtaining information regarding diabetes	-0.02	-0.46	0.50
Employment status	0.03	0.56	0.25
Self-efficacy	0.12	2.25	0.02 <sup>a</sup>
Subjective norm (social pressure)	0.01	0.25	0.77
Attitude toward behavior	0.01	0.25	0.78
Behavioral intention	0.23	4.52	0.001 <sup>b</sup>

<sup>a</sup> $P < 0.05$ , <sup>b</sup> $P < 0.01$  is significant.

beliefs are, the more reliably they will perform health behaviors [15]. One study using constructs of the different theories shows that the effect of self-efficacy on a given behavior through intention is stronger than other psychological and social factors and this is consistent with our results [24].

A study using TPB in the field of blood donation strongly supported self-efficacy as a good predictor of intentions. This investigation demonstrated the importance of self-efficacy in support of blood donation, but also stressed the importance of including self-efficacy in the theory of planned behavior [25]. Another study testing the TPB for predicting breast self-examination provided empirical support for separating the two constructs of self-efficacy and perceived behavioral control, and demonstrated that self-efficacy predicts intention to perform breast self-examination and actual behavior better than other structures particularly perceived behavioral control [26]. Self-efficacy not only has an indirect effect on physical activity, but it also affects physical activity directly. Our study demonstrated its direct effect on behavior based on regression analy-

sis results ( $\beta=0.115$ ,  $P<0.05$ ). One study examining the TPB on helmet use behavior revealed that self-efficacy was the strongest predictor of intention compared with other constructs of the theory, which is also consistent with our study findings [16], and our findings have also been supported by various additional studies [27,28]. These results confirm the influence of self-efficacy in theory and theory-driven interventions. Therefore, if self-efficacy is used in extending theories and designing interventions, it will increase the ability of these programs to change behavior.

Social pressure or subjective norm is another theoretical framework construct that showed significant positive correlation with physical activity behavior through intentions ( $\beta=0.126$ ,  $P=0.05$ ). This demonstrates that social pressure is able to predict intention to engage in physical activity. This result is in concordance with results of a study by Omondi et al. They found a positive and significant correlation between subjective norms and intention to perform physical activity in diabetic patients ( $\beta=0.38$ ,  $P<0.05$ ), and they suggested that the greater the pressures of the patients' wives, family members, their friends, physicians and health experts for performing health behaviors, the greater the patients' adherence rate [29]. A study conducted by the Blue [30] examining determining factors affecting diabetics' intention to perform physical activity and healthy eating, revealed that the patients' subjective norms correlated with their intention.

In addition to studies by Omondi and Blue, other studies based on TPB, Trost et al. [31] and Symons Downs & Hausenblas [32] have confirmed the presence of an association between subjective norms and intentions. All of the above results were consistent with the results of our study.

Although this study, explored the relationship between subjective norms and the intention to perform physical activity behavior, a review of studies based on TPB, indicates that subjective norm has always been a weaker predictor compared with attitude and perceived behavioral control.

In Bozionelos's theory-based study on exercise behavior [33], no significant relationship was detected between subjective norm and behavioral intention. These findings were contrary to the results of this aspect of our study. The basis of these conflicting results in studies examining subjective norms can be found in differences between health behavior practices due to individual, social and cultural characteristics of study subjects. In 2004, Ajzen and Fishbein cited that the relative importance of subjective norms, attitudes and perceived behav-

ioral control in predicting intentions may change from one behavior to another or from one society to another. However, the results of this study indicated that subjective norm an effect on physical activity through intentions and it should be considered in designing educational interventions.

Intention to perform physical activity in diabetic patients is influenced not only by social pressures and self-efficacy, but also by attitude [34]. In the current study, regression analysis results ( $\beta=0.120$ ,  $P<0.05$ ) demonstrated that a relatively positive attitude towards physical activity behavior among diabetics was the factor that most encouraged patients to adopt this behavior. When people feel that a behavior may lead to positive health outcomes, it is more likely to be adopted and maintained. This finding was supported by the results of previous research regarding the effects of attitudes on health behaviors.

For example, in 1996, a study by Van Ryn et al. [35] showed that diabetic women who had more positive attitudes towards physical activity in comparison with women with negative or weak positive attitudes attempted more physical activity. In addition, a 2001, study by Surit [36] confirmed our study findings regarding attitude. They concluded that there is a significant positive correlation between attitude towards self-care and diabetics' behaviors. Therefore, according to the results of this study and previous studies, attitudes like self-efficacy and subjective norms were indirect predictors of physical activity behavior and should be considered in the design of educational programs.

Based on the results of this study, both constructs of the suggested model predict and explain physical activity in diabetic women through behavioral intention both indirectly and directly. Behavioral intention or motivation had better predictive strength in comparison with other constructs of the model ( $\beta=0.234$ ,  $P<0.001$ ). The high predictive strength of behavioral intention was consistent with findings in a study by Sutton [37] which found that the intention to perform a specific behavior is the first and the best behavior predictor. The results this present study support that finding. In addition to the desired model variables, experiences and personal characteristics as external factors of the proposed model can also affect rates of physical activity in diabetic women and can both directly and indirectly explain and predict them. In this study, knowledge has a direct relationship with the desired behavior ( $\beta=0.213$ ,  $P<0.001$ ) and was the second best predicting factor of behavior after behavioral intention. This relationship indicates that the more knowledge diabetics have about their treat-

ment methods, particularly with regard to the importance of physical activity, the more likely they may be to adopt health behaviors and maintain them.

In order for a diabetic patient to be successful in caring about his/her disease, he/she must have sufficient knowledge about health promoting behaviors. Therefore, knowledge regarding disease management should be considered as an important treatment factor. Research results by Jiang et al. [38], confirm the importance of the link between disease management knowledge and health behavior promotion.

A literature review shows that, although individual awareness about diabetes and its treatment methods is necessary, it is not sufficient on its own. A study by Chan and Molassiotis [39] suggests that although providing adequate knowledge for diabetics is important for enhancing self-care behaviors, personal beliefs and other psycho-social factors should also be considered in treating this disease. In this study, level of education was also considered as a predictor of physical activity, as it affects behavior both directly and indirectly, and this result is consistent with other studies [40]. Therefore, the higher the diabetics' level of education, the better they will understand the importance of health-related issues and improve their health by adopting positive health behaviors.

Although this study provides important information about the relationships between physical activity and individual and environmental factors, several limitations should be considered. First, a cross-sectional design was used to describe the relationship between variables. The main characteristic of cross-sectional design is that all data are collected at one time period, thereby limiting the ability to identify cause-and-effect relationships between variables. Second, results cannot be generalized beyond the study sample and therefore can be generalized only to populations with similar features. Third, the data of this study were collected using a self-reported questionnaire. Participants may underestimate or overestimate their physical activity behavior, which may have affected the study findings.

Overall, the present study highlighted the relative importance of constructs of the suggested model, especially the construct of self-efficacy, and their relationship with behavioral intention and physical activity. Therefore, it is essential to consider these relationships when designing educational interventions to promote physical activity behavior in women with type 2 diabetes. For example, in order to increase motivation or intention to perform physical activity among diabetic pa-

tients, health care providers should first focus on the diabetics' self-efficacy, then intervene in subjective norms, attitudes and other factors. Since health care providers can increase the perceived physical activity self-efficacy of diabetics, they should use instructional methods such as verbal persuasion, emotional motivation, modeling and previous successful experiences in the field of physical activity. The more the self-efficacy of patients improves after educational interventions, the greater will be their adherence to self-care behaviors, such as physical activity, which in turn will lead to better diabetes control.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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