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ORIGINAL ARTICLE

Predictive Power of the trans-theoretical model of Physical Activity in Patients with Type-2 Diabetes

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ABSTRACT

Sedentary lifestyle is one of the most important modifiable factors associated with diabetes. Nevertheless, the level of physical activity in diabetics is poor. This study aimed to determine the predictive power of the transtheoretical model (TTM) of physical activity behavior in patients with type-2 diabetes. This study was conducted on 393 type-2 diabetic patients in Khorramabad in 2013, in which the participants were selected by the convenience sampling method. The data were collected through a 5-part questionnaire, and were analyzed by the statistical software of SPSS-18 using Pearson's correlation coefficients, chi-square test, t-test, ANOVA, and multiple regressions. In this study, most of the participants (48.9%, 192 patients) were in Precontemplation stage, and only 15% and 6.6% were in the Maintenance and Action stages respectively. The results showed that most of the illiterate subjects were in the Precontemplation and Contemplation stages, and most of those with college education were in the Action and Maintenance stages. The mean daily exercise was 11.9±20.6 minutes, the mean was zero in the Precontemplation and Contemplation groups, and it was significantly higher in the Maintenance group than that in the other groups. A significant negative relationship was found between the mean daily exercise and perceived benefits, and a significant positive relationship between the mean daily exercise and processes of change, self-efficacy, and decisional balance. The mean daily exercise had a significant positive correlation with self-efficacy. Multiple regression showed that 33.8% of the variance of the mean daily exercise can be explained and predicted by the TTM constructs.The theory of stages of change had a good predictive power of physical activity levels in diabetic patients. Therefore, considering the constructs of this theory, it is recommended that physical activity be promoted and related educations be provided in diabetic associations and health care centers.

Keywords: *physical activity, diabetes, TTM, self-efficacy*

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INTRODUCTION

Diabetes is one of the main problems in the health system (1), and a growing threat to global health (2). Diabetes is a costly disease, and the main cause of cardiovascular disease, blindness, developed kidney failure, and amputation in the adult population in many countries (3). The complications and the financial burden of diabetes are enormous and growing (4, 5), which are associated with the increased risk of cardiovascular disease and premature death (5).

The destructive complications of the disease are another reason for the importance of the disease, and diabetics are exposed to these consequences, the most important of which are diabetic neuropathy and vascular disorders (1). Given the economic and social costs of the disease, it is necessary to take measures to reduce the risk of the disease development and to control the affected individuals. Evidence suggests that changes in lifestyle can be helpful in preventing and controlling diabetes and its complications (5). Performing physical activity and changing sedentary lifestyle are among the lifestyle changes whose positive effects have been reported by interventional trials (6).

Sedentary lifestyle is known as one of the most important modifiable factors associated with diabetes (7). Physical activity is considered as the starting line of prevention and control of type-2 diabetes (8). Epidemiological studies have demonstrated that the possibility of type-2 diabetes development in active individuals is 30-50% lower than the possibility in inactive ones, and this decreased rate is also true for coronary heart disease (7).

The importance of physical activity in disease control in diabetic patients has been emphasized (9). Nevertheless, diabetics often choose a sedentary lifestyle (10). Evidence suggests that walking 5 minutes an hour can decrease metabolic dangers and help in weight control (11). Moderate physical activity can improve cholesterol and glycemic indices in diabetics (12). The short- and long-term effects of exercise on controlling hyperglycemia have been demonstrated (13).

Despite the key role of physical activity in the management of diabetes, current evidence suggests that diabetics ignore physical activity and do not have a favorable condition in this regard (14). In a study by Ronda et al. (2001), more than 60% of the subjects did not have the necessary physical activity, and more than half of them did not intend to exercise in the next six months (15). In another study, 74 % of the men and 76 % of the women reported their physical activity as insufficient, and reported a need to increase their physical activity (16). In a study conducted in the US by Zhao et al. (2011), only 25% of the diabetic patients had met physical activity recommendations (17). Research has shown that physical activity level in diabetic patients is even lower than the level in the general population (18). Poor Knowledge of physical activity in diabetics may prevent the desired behavior (19, 20). Another barrier to physical activity in sedentary individuals is their unawareness and unconsciousness of their inactivity (20). These issues confirm the necessity of providing appropriate solutions for the optimal control of diabetes. In order to plan for improving physical activity and understanding its facilitating, inhibiting, and cognitive factors, it is essential that a comprehensive understanding of the causes of the behavior be achieved through behavioral theories. One of these theories is the transtheoretical model (TTM), which was proposed by Prochaska and DiClemente as a comprehensive model of behavior change to study behavioral determinants. In this model, it is assumed that individuals can be in different stages of readiness to change, and therefore process through a collection of stages in order to change behavior. The stages include Precontemplation, Contemplation, Preparation, Action, and Maintenance. In the Precontemplation stage, an individual is not aware of behavior type, and lack of interest in changing is observed.

In the Contemplation stage, the individual, in addition to evaluating the issue reasonably and logically, will also consider the outcomes and consequences of the behavior. The next presumption is that the individual is ready for change and plans to achieve behavioral objectives. In the next stage, the individual achieves behavioral change practically and shows the right behavior, but the behavior change is not completely stabilized. Finally, the individual attempts to achieve maintenance in successful behavioral change in order to stabilize it further. In this stage, the behavior is formed more than six months after its performance (Maintenance). The behavior change model is able to promote self-efficacy and decisional balance in order to differentiate between the benefits (pros) and costs (cons) of the desired behavior (21). Generally, the model suggests that the individual makes much effort prior to any success in exercise behavior change, and passes through the five stages of change. The relationship between these stages and other constructs of the model including decisional balance and self-efficacy is predictable (21).

Any basic information on the stages of regular physical activity can be applied to plan appropriate and effective interventions in order to start physical activity (22). This study was conducted to determine the status of physical activity in patients in Khorramabad, west of Iran.

METHODS

This cross-sectional study included type-2 diabetics in the city of Khorramabad, west of Iran, in 2013. The convenience sampling was applied and 400 patients were selected. Seven patients were excluded since their questionnaires had not been completed accurately, and 393 were excluded in the study. After the study was approved, the researchers attended the diabetes centers. After the patients were provided with the necessary information regarding the purpose of the study, informed consents were obtained from them and the questionnaires were distributed among them. To collect the data, a 5-part questionnaire was applied. The first part of the questionnaire consisted of the demographic information including age, educational level, weight, and height; perception of body; perceived benefits and barriers; and determination of change stage by the Stage of Exercise Change Questionnaire (SECQ) prepared by Marcus et al. (23). The second part was the standard questionnaire of the Exercise Behavior Scale (Godin & Shephard), which assesses weekly exercise behavior (24). The third part was the Process of Change Questionnaire (cognitive and behavioral) prepared by Nigg et al. This questionnaire consists of 30 questions: questions 1 to 15 assess the cognitive strategies and 16 to 30 the behavioral strategies. They

include the items of *never*, *rarely*, *sometimes*, *often*, and *always*, having 1 to 5 points respectively (25). The fourth part is the Exercise Self-efficacy Questionnaire developed by Nigg & Riebe. This questionnaire includes six questions with a 5-point Likert scale (1 to 5 meaning uncertain to completely certain respectively), with 1 to 5 points respectively (26). The fifth questionnaire, developed by Plotnikoff et al., assesses the decisional balance construct and has ten questions with a 5-point Likert scale (1 to 5 meaning extremely important to not important respectively), with 1 to 5 points respectively (27). The data were analyzed using the statistical software of SPSS-18 and through descriptive and inferential analyses. Descriptive analyses including central distributions were performed based on type of variable (qualitative and quantitative). Inferential statistics, including Pearson's correlation coefficient, were applied to investigate the correlations between the variables of the study and the TTM constructs. To compare the means, the chi-square test was applied, and Fisher's exact test was used in case of low frequencies. The ANOVA was applied to make multiple comparisons in the quantitative variables including age, and the dependent t-test was utilized in paired comparisons, considering the assumptions of the parametric tests. Multiple regression was applied to determine the predictive power of behavioral variance.

RESULTS

In this study, most of the participants (74%, n=291) were married, 22.6% were widowed, and 2% were unmarried. Most of the participants (57.5%, n=226) were illiterate and 24.9% had primary school education. Moreover, 70.7% (n=278) had a history of previous training in physical activity (Table 1), 63.4% (n=249) were working in assembly line jobs (tool assemblers, sewing machine operators, etc.), and 16.3% were employees. The mean age of the participants was 58.5±11.4 years, the mean weight was 71±12.6 kg, and the mean diagnosis duration was 7.2±7.5 years.

Most of the study participants (489%, n=192) were in the Precontemplation stage, and only 15% were in the Maintenance and 6.6% the Action stage (Yes, I have been exercising regularly for less than 6 months). The results showed that most of the illiterate patients (74.3%), those with primary school education (51.1%), and those with junior high school education (52.7%) were in the Precontemplation and Contemplation stages, while most of the patients with college education (53.3%) and those with senior high school education (40%) were in the Action and Maintenance stages. Therefore, a significant difference was found in the distribution of the patients in the stages of behavior change in terms of level of education (Table 2). Also, 62.2% of the married subjects and 69.6% of the widowed ones were in the Precontemplation and Contemplation stages, while the majority of the divorced patients were in the Maintenance process. As a result, a significant difference was found in the distribution of the patients in the stages of behavior change in terms of marital status.

Significant negative correlations were found between age and the mean scores of awareness, processes of change, self-efficacy, and decisional balance, so that the scores of these variables decreased significantly with an increase in age. A significant positive correlation was found between the patients' weight and their mean score of awareness, so that their Knowledge scores increased as their body weight increased.

No significant differences were found between the mean scores of the patients' Knowledge of physical activity in terms of a history of previous training in physical activity ($P < 0.001$). The mean of Knowledge score in the patients with a history of previous training in physical activity was 3.3 (SD=1.5), and the lowest score of 3.1 (SD=1.6) was found in the group without a history of previous training.

The mean daily exercise was 11.9±20.6 minutes, with a mean of zero in the Precontemplation and Contemplation stages, and a significantly higher in the Maintenance stage compared to the means in the other stages. Most (75%) of those with the mean daily physical activity of less than 15 minutes were in the Preparation, and most (57.6%) of those with the mean daily physical activity of more than 30 minutes were in the Maintenance stage (Table 3).

The mean Knowledge score was 3.2 (SD=1.5), the mean score of perceived benefits was 14.1 (SD=4.3), the mean score of perceived barriers was 19.2 1 (SD=6.2), the mean score of processes of change was 70.2 (SD=25.8), the mean score of self-efficacy was 9.3 (SD=3.7), and the mean score of decisional balance was 23.6 (SD=8.1). A significant negative correlation was found between the mean daily exercise and perceived benefits. Also, a significant positive correlation was found between the mean daily exercise and processes of change, self-efficacy, and decisional balance, meaning that the scores of these variables increased with an increase in daily activity. There was also a significant correlation between the mean weekly exercise frequency and self-efficacy (Table 4).

No significant differences were found between the mean scores of perceived benefits and perceived barriers in the different stages of behavior change, while significant differences were found in the mean scores of processes of change, self-efficacy, and decisional balance ($P < 0.001$). The patients who were in the Maintenance and Action stages obtained significantly higher scores compared to those in the other

stages (Table 5). The results of multiple regression showed that 33.8% of the variance of the mean daily exercise can be explained and predicted by the TTM constructs.

DISCUSSION

Regular physical activity is associated with an improvement in the metabolic control of the risk factors of cardiovascular diseases, and enhancement of life quality in diabetics (28). Therefore, the importance of physical activity in controlling diabetes is undeniable (9). Despite this, diabetics often choose sedentary lifestyle for themselves (10). This study aimed to determine the predictive power of the transtheoretical mode (TTM) of physical activity in patients with type-2 diabetes. According to our knowledge, this study is the first theory-based evaluation of physical activity status in patients with diabetes in Lorestan province (west of Iran), which provides useful information for researchers and planners in the province in this regard. The TTM was applied as the theoretical framework of our study. This model has been applied in recent years to evaluate numerous behaviors including regular physical activity and successful weight control (29).

The main characteristic of the model is that it introduces behavior change as a gradual process with different stages, through which individuals pass to change (34). The model consists of five stages of Precontemplation, Contemplation, Preparation, Action, and Maintenance.

In the Preontemplation stage, the individual does not intend to change behavior within the next six months, which can be due to lack of knowledge and information about the desired behavior, previous negative experiences that had been led to failure, and lack of motivation. In the Contemplation stage, the individual intends to change behavior within the next six months, and contemplate the benefits (cons) and costs (cons) of the behavior. In the Preparation stage, the individual intends to show the behavior within the next month, and seeks for the plans, the instruments, and the prerequisites of behavior change. In the Action stage, the individual acts on the intended behavior, but the behavior change has lasted for less than six months. In the Maintenance stage, as the last one, the behavior change has lasted for more than six months, and the individual has reached appropriate self-efficacy in tempting conditions (21).

In our study, the mean of daily physical activity in the patients was far less than the recommended level, and the majority of the patients (48.9%, n=192) were in the Precontemplation stage, and only 15% and 6.6% were in the Maintenance and Action stages. These results are indicative of this sad fact that the studied diabetics were not associated with physical activity. These findings are consistent with the results of the study by Farmanbar et al. (2009) in which most of the subjects (81%) were in the three stages of Precontemplation, Contemplation, and Preparation (30). Moreover, the results are in agreement with the results of the study by Ronda et al. (2001) in which 60% of the subjects did not have sufficient physical activity and more than half of the subjects were in the Precontemplation stage (15), and also with results of Politikoff et el.'s study (2006) in which 71.9% of the patients had physical activity lower than the recommended level (31).

In another study, 74% of the men and 76% of the women reported their physical activity level as insufficient, and expressed a need to increase their physical activity (16). In the study by Zhao et al. (2011), only 25% of the diabetic patients were engaged in recommended physical activity (17). It can therefore be inferred that the majority of the studied diabetic patients did not intend to perform any physical activity in the next six months or even the next month, and this is a worrying issue. Evidence suggests that diabetics' intention is associated with physical activity (32). Therefore, given that most of the diabetic patients did not intend to have any physical activity in the next six months or even the next month, the level of physical activity in them is expected to be low, which is consistent with our results. In accord with our inferences, physical activity was associated with the stages of the TTM in the study by Jalilian et al. in (33), and this relationship was also reported by the studies by Kirk et al. in 2007 and Kim et al. in (34, 35).

Our results indicated that most of the illiterate patients and those with primary and junior high school educational level were in the Precontemplation and Contemplation stages, while most of those with college degrees and senior high school education were in the Action and Maintenance stages. Moreover, the highest mean scores of Knowledge, processes of change, and self-efficacy were found in the patients with college education. These results are in agreement with the results of the study by Garbe et al. (2008) in which the individuals with higher educational levels were in the stages of Action and Maintenance, and those with lower educational levels were more likely in the Precontemplation and Contemplation stages (36). These results were predictable considering the obtained results and given that the patients with higher education obtained higher mean scores in the constructs and Knowledge. This is in line with similar studies in which physical activity in the diabetic patients increased with an increase in their educational level and Knowledge scores (17, 31, 37), while physical activity was not associated with educational level in Inda et al.'s study (28).

Most of the married and widowed patients in our study were in the Precontemplation and Contemplation stages, while most of the divorced patients were in the Maintenance stage, showing a significant difference. This finding is inconsistent with the results of Graber et al.'s study (2008) in which marital status was not significantly correlated with the stages of behavior change (36), and also inconsistent with the results of Varo et al. (2003) in which the widowed and divorced people were less active than the others (38). This contrast can be attributed to the cultural and social conditions of the studies. Married people are more responsible than others and they spend most of their time on daily affairs, and therefore have less time for physical activity. However, this interpretation is not always correct.

No significant relationships were found between patients' weight and the stages of behavior change, and this is not in agreement with the results of Garber et al.'s study in which the persons with lower weight were more likely in the Action and Maintenance stages, and the overweight persons were 33% less likely in the Maintenance stage than the obese individuals (36). This means that obese individuals are more motivated to have weight-losing activities including physical activity due to obesity-related problems and movement limitations (39). Obesity, as an unfavorable physical condition, is a barrier to physical activity (40).

In our study, significant negative relationships were found between age and Knowledge, processes of change, self-efficacy, and decisional balance, so that the mean scores of these variables deceased with an increase in age, and also the physical activity level in the diabetics decreased with an increase in age. Plotnikoff et al.'s study (2006) also found an inverse correction between physical activity and age (37), but no correction was found between physical activity and age in Inda et al.'s study in 2006 (28).

In the present study, there were no significant differences between the mean scores of perceived benefits and perceived barriers in various stages of behavior change. Based on the inferences, when individuals have a higher Knowledge of behavioral benefits, they are expected to show more behavioral changes. Although the current evidence concerning the multi-dimensional benefits of physical activity is convincing, the behavior of physical activity in diabetics is not compatible with current inferences (40). Although in our study perceived barriers did not have any relationship with the stages of behavior change in the patients, this concept has a vital role in patients' physical activity in the self-management of the intended behavior (40). Significant differences were found in the mean scores of self-efficacy and decisional balance ($P < 0.001$). The patients who were in the Action and Maintenance stages had significantly higher scores than the others.

In this study, no significant correlation were found between the mean duration of disease diagnosis and the mean physical activity, being consistent with Garber et al.'s study in 2008 (36), but not compatible with Plotnikoff et al.'s study in 2006 in which recently-diagnosed diabetics were more active than the others in terms of physical activity (31). Perhaps it can be said that patients pay less attention to behavioral barriers when they are recently diagnosed with the disease, and that they pay more attention to the benefits of the behavior. Therefore, decisional balance in diabetics is toward adopting the behavior. It is an assumption, but, as it was mentioned, the incidence of physical activity behavior in newly-diagnosed patients is higher. Decisional balance is a complementary part of the TTM, and one of the most important constructs in understanding the intentional process of behavior change and adopting new behaviors. According to this construct, individuals decide and take action to change or not to change behavior based on their perception of the things they expect to obtain through behavior change and the things they expect to lose through performing a behavior. When moving toward any decision, individuals consider the benefits (pros) and costs (cons) of the intended action. In behavior change, this is called "decisional balance", a process in which individuals cognitively evaluate the benefits (pros) and costs (cons), and assess the reason of change or lack of change (21).

In our study, a significant correlation was found between the mean daily exercise and self-efficacy, and this result is consistent with a meta-analysis in which self-efficacy was higher in the individuals with regular physical activity (41). Therefore, factors affecting diabetics' capabilities in the domain of care and disease management should be taken into account (42, 43), and one of the most important of these factors is self-efficacy (44). Self-efficacy, or perception of the ability to perform a behavior successfully, is an important principle that links Knowledge and action. Self-efficacy affects behavior selection, time, and condition, as well as the amount of effort and persistence needed to perform a specific behavior (45). Albert Bandura considers self-efficacy as the most important prerequisite for behavior change (45). Various studies have shown that focusing on patients' self-efficacy can affect diabetes management (44, 46). Therefore, in order to make an intervention in a diabetic population, evaluation of self-efficacy is inevitable to have a more effective and more efficient intervention. Also, self-efficacy is an important construct to improve the ability of diabetic patients, and acceptance of responsibility in care and disease control by diabetics themselves is a vital prerequisite (43). Various studies have shown that self-care and self-management are among the necessary preconditions for the appropriate management of diabetes

and its complications. Furthermore, an improvement in self-efficacy has an effective role in correcting self-care (47).

Our study demonstrated a significant relationship between the demographic and disease-related factors and self-efficacy. The results of this study showed the highest self-efficacy scores in the patients with college educational level, being consistent with the results of a similar study (47). One of the reasons for the relationship between educational level and self-efficacy is that individuals with higher educational level can understand the information of health literacy related to diabetes better, and decrease the unfavorable consequences of unfavorable control of the disease or postpone their incidence (47, 48).

Establishment of an effective communication with service providers to diabetics can be a necessity for this positive and efficient perception. Lee at al.'s study showed that establishment of trust between patients and care providers in care and treatment significantly affected self-efficacy and adherence to the recommended therapeutic regimen in the diabetics, and this showed a direct relationship between self-efficacy and self-control (49). In addition to the demographic factors, various studies have shown that psychological and social factors are also related to physical activity (50). Among these factors, self-efficacy is the predominant variable (51). Research has shown that those with high self-efficacy consume significantly more energy to pursue physical activity (52). Qualitative studies have also shown that self-efficacy is associated with different levels of physical activity (53), and the role of self-efficacy in starting and maintaining healthy behaviors have been reported by several studies in other realms (54).

In the present study, no significant differences were found between the mean scores of the constructs in terms of marital status. However, Tol et al.'s study showed a relationship between self-efficacy and marital status (45). This can be due to this issue that married individuals, and probably those who have children, feel more responsibility to their family through maintaining their own health since diabetes, as a chronic and serious disease, imposes a financial burden on the family directly and indirectly (5).

In our study, no significant relationship was found between Knowledge and the mean daily exercise and exercise duration. In fact, we can say that the patients' Knowledge did not have any relationship with physical activity. In this regard, the study by Farmanbar et al. also showed that many people have the necessary information on active lifestyle, but they have difficulty in starting and maintaining physical activity including exercising (30).

Multiple regressions in this study revealed that 33.8% of the variance of the mean daily exercise can be explained and predicted with the TTM constructs, and this is consistent with the study by Farmanbar et al. (2009) in which the constructs of processes of change of behavioral strategies and self-efficacy in exercise had the predictive power of the stages of exercise behavior change with the path coefficients of 0.45 and 0.20 respectively (30).

The behavioral strategies of exercise behavior change including behavior substitutes, receiving social support, having plans and commitment to do the plans, controlling environmental stimuli, and managing reinforcement and reward have the strongest relationships with exercise behavior. The construct of processes of change with the highest path coefficient is the strongest predictor of exercise behavior (30). Also, our results are consistent with the results of Lowther et al.'s study (56)

The construct of processes of change is indicative of cognitive, emotional, and behavioral strategies of behavior change, and apparent and hidden actions that people can use to adjust the intended behavior. The processes of change include ten processes that are divided into the cognitive processes (consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, and self-liberation) and the behavioral processes (social liberation, counter conditioning, stimulus control, reinforcement management, and helping relationships).

In the cognitive processes, individuals obtain the necessary information by themselves, but in the behavioral processes they obtain the information from the environment. Research has shown that the cognitive processes are applied in the stages before the Action stage including the Precotemplation, Contemplation, and Preparation stages, while the behavioral processes are mostly applied in the Action and Maintenance stages. According to the TTM, the ten above-mentioned processes are derived during processing through the stages, and the application of these processes in appropriate stages can facilitate the movement to the next stage, while the improper application or non-application of these processes results in an interruption in the movement toward the next stage. No significant relationship was found between Knowledge and the mean daily exercise and exercise duration in this study. Moreover, concerning the results of the regressions, we can say that the patients' Knowledge was not an appropriate predictor of physical activity. In this regard, the study by Farmanbar et al. showed that although many people have sufficient information on active lifestyle, they have difficulty in starting and maintaining physical activity including exercising (30). This issue is confirmed by the results of the present study since the cognitive processes including the reinforcement and reward strategy was not effective in

increasing the Knowledge and knowledge of exercise behavior in the university students, and the application of behavior change strategies was significantly important.

Table 1: Relative frequency of the participants of the study in terms of marital status

Variable		Frequency	Percentage
Marital status	Unmarried	8	2
	Married	291	74
	Divorced	5	1.3
	Widowed	89	22.6
Educational level	Illiterate	226	57.5
	Primary school	98	24.9
	Junior high school	19	4.8
	Senior high school	35	8.9
	College	15	3.8
Previous training	Yes	278	70.7
	No	114	29
	No answer	1	0.3
Total		393	100

Table 2: Frequency distribution of the patients and performing physical activity behavior in the stages of behavior change in terms of educational level

Educational level		Stages of change					Total	P-value
		Precontemplation	Contemplation	Preparation	Action	Maintenance		
Illiterate	Frequency	139	29	30	9	19	226	<0.001
	Percentage	61.5	12.8	13.3	4	8.4	100	
Primary school	Frequency	37	13	19	8	21	98	
	Percentage	37.8	13.3	19.4	8.2	21.4	100	
Junior high school	Frequency	6	4	3	5	1	19	
	Percentage	31.6	21.1	15.8	26.3	5.3	100	
Senior high school	Frequency	7	7	7	2	12	35	
	Percentage	20	20	20	5.7	34.3	100	
College	Frequency	3	2	2	2	6	15	
	Percentage	20	13.3	13.3	13.3	40	100	
Total	Frequency	192	55	61	26	59	393	
	Percentage	48.9	14	15.5	6.6	15	100	

Table 3: Frequency distribution of the patients and means of performing physical activity behavior in the stages of behavior change

Physical activity		**Stages of change**					**Total**	**P-value**
		Precontemplation	**Contemplation**	**Preparation**	**Action**	**Maintenance**		
No activity	Frequency	192	55	0	0	0	247	<0.001
	Percentage	77.7	22.3	0	0	0	100	
Less than 15 min	Frequency	0	0	18	2	4	24	
	Percentage	0	0	75	8.3	16.7	100	
15-30 min	Frequency	0	0	36	17	36	89	
	Percentage	0	0	40.4	19.1	40.4	100	
More than 30 min daily	Frequency	0	0	7	7	19	33	
	Percentage	0	0	21.2	21.2	57.6	100	
Total	Frequency	192	55	61	26	59	393	
	Percentage	48.9	14	15.5	6.6	15	100	
Daily exercise (min)		0	0	24.4±12.4	30.1±9.6	41.0±29.8	11.9±20.6	<0.001

Table 4: The relationship between the constructs of the transtheoretical model and performing physical activity

	Knowledge	**Perceived benefits**	**Perceived barriers**	**Processes of change**	**Perceived self-efficacy**	**Decisional balance**	**Mean daily exercise**	**Mean weekly exercise**
knowledge	1							
Perceived benefits	-0.05	1						
Perceived barriers	-0.03	0.03	1					
Processes of change	0.125*	-0.109*	0.07	1				
Perceived self-efficacy	0.05	-0.07	0.04	0.488**	1			
Decisional balance	0.09	-0.138**	0.07	0.606**	0.416**	1		

Mean daily exercise	-0.02	-0.144**	0.159**	0.524**	0.410**	0.387**	1	
Mean weekly exercise	0.09	-0.01	0.06	0.05	0.152**	0.09	0.04	1
Mean scores	3.2±1.5	14.1±4.3	19.2±6.2	70.2±25.8	9.3±3.7	23.6±8.1	11.9±20.6	0.6±2.2

*Significant at P <0.05 **Significant at P <0.01

Table 5: Mean scores of the constructs of the transtheoretical model in the stages of behavior change

Constructs		Stages of change					Total	P-value
		Precontemplation	Contemplation	Preparation	Action	Maintenance		
Perceived benefits	Mean	14.8	13.9	13.4	13.6	13.2	14.1	0.06
	Standard deviation	5.5	2.5	2.5	2.2	2.7	4.3	
Perceived barriers	Mean	18.7	19.6	19.8	19.7	20.1	19.2	0.5
	Standard deviation	7.2	4.9	4.4	5.6	5.3	6.2	
Processes of change	Mean	58.6	78.4	74.5	78.1	92.6	70.2	<0.001
	Standard deviation	20.5	24	24.2	20.9	27	25.8	
Perceived self-efficacy	Mean	8.1	8.9	10.2	11.3	12.2	9.3	<0.001
	Standard deviation	2.7	2.2	3.6	4.4	5.2	3.7	
Decisional balance	Mean	20.4	25.5	26.7	25.1	28.4	23.6	<0.001
	Standard deviation	7.6	6	8.8	7.4	6.7	8.1	

Table 6: The predictive power of the variance of the mean daily physical activity by the constructs of the transtheoretical model

Construct	Beta	t	P	R^2
Knowledge	-0.091	-2.176	0.03	0.338
Perceived benefits	-0.089	-2.131	0.03	
Perceived barriers	0.115	2.763	0.006	
Processes of change	0.387	6.9	<0.0001	
Perceived self-efficacy	0.189	3.9	<0.0001	
Decisional balance	0.062	1.7	0.0242	

CONCLUSIONS

The appropriate predictive power of the studied constructs of the transtheoretical model of the mean physical activity in this study is indicative of the application of this model in exercise. As the final conclusion based on the results of the present study, we can say that, in planning TTM-based interventions to promote and maintain exercise behavior, more effective interventions can be designed through reinforcing and concentrating on the constructs with the highest predictive power regarding exercise behavior. To achieve this goal and to observe progress in the stages of exercise behavior as an intermediate factor, the strategies of exercise behavior change can be reinforced based on their predictive power and order. The strategies may include using behavioral substitutes such as getting off vehicles at a station away from the destination and walking the distance, receiving social support by exercising with friends and classmates, having plans and commitment to follow them, controlling environmental stimuli, for example, putting exercise clothes in a visible place, managing reinforcement and reward, increasing self-efficacy, and experiencing as well as understanding the benefits of exercising, particularly the early benefits, for example happiness and the psychological benefits. Following these strategies will finally result in the establishment, promotion, and maintenance of exercise behavior among people.

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