Original Article

The Effect on Health Outcomes of Post-Intervention Transtheoretical Model-Based Motivational Interview in Adults with Type 2 Diabetes Mellitus: Follow up a Cross-Sectional Study

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ABSTRACT

Introduction: The individuals with type 2 diabetes mellitus were supported with the individual motivational interview in the previous randomized controlled trial. The aim of this study was to assess whether the effect of motivational interview persists relative to the self-efficacy, metabolic control, and health-behavioral change of them.
Methods: This study was contacted a cross-sectional design. This study was the follow-up to the previous randomized controlled trial. Total of 32 participants, including 18 from the intervention group and 14 from the control group, were contacted. No new intervention was performed to previous groups (control and intervention). The participants in the intervention and control groups were contacted by phone in the 18th month, and their self-efficacy, metabolic control and health behaviors were assessed.
Results: The intergroup comparisons showed that the difference between the sixth month and 18th month was statistically significant except for medical treatment self-efficacy subscale score, postprandial blood glucose and waist circumference. The groups were similar in terms of their use of medicine, nutrition and physical activity behavior stages according to the 18th-month follow-up.
Conclusion: This study found that the self-efficacy scores of the intervention group decreased negatively, and their metabolic values increased negatively in the 18th months, compared with the sixth month. In this respect, it is recommended that motivational interviews should be carried out at certain intervals assessing the characteristics of participants without discontinuing them after the intervention.

Introduction

According to the reports of international health organizations, the prevalence of diabetes mellitus (DM) has increased in many parts of the world in recent years. DM is one of the most important public health problems because it affects the life span and quality of life; it can result in the loss of organs and function; it requires continuous medical care; and imposes social and economic burdens as well as workforce loss.[1,2] The global prevalence of DM is 8.3%.[1] Studies conducted in Turkey have shown that the prevalence of DM was 7.2% in 1998,[3] 13.7% in 2010,[4] 14.85% in 2013,[1] and that it is gradually increasing. The priority of individuals and health professionals in disease management is to prevent acute complications and to reduce the risk of chronic complication.[5] DM also involves interventions and restrictions such as the need of frequent insulin injection, costly medicines, a special diet, and extended hospital stays resulting from infections and other complications of the disease. These restrictions can affect the mental state of individuals. Hormones released by these negative emotions can increase the level of blood glucose and may have the anti-insulin effects that cause long-term diabetic complications.[6,7] The cost of increase in the prevalence of type 2 DM and the complications resulting from the extended human life span is very high. Moreover, identifying individuals at risk of developing type 2 DM and the lifestyle changes aimed at an increase in physical activity and weight control are included in the important targets for the prevention of the disease. Therefore, it becomes important for individuals to undergo medical check-ups regularly based on their health status (once every three months, once every six months, and once a year).[5] In addition to the usual care, planning and using interventions based on effective, evidence-based psychological approaches is important for medical and chronic diseases in general, and especially for diabetes.[7] The results of the previous randomized controlled trial of the present study support the importance of continued motivational interviews in addition to the usual care.[8]

In this case, the motivational interview is one of the practical and effective methods that are used to help persons change their behaviors.[9] Studies on conducting motivational interviews with patients with DM have shown that these interviews are effective for improving health.[10,11] The Transtheoretical Model (TTM) plays an integral role in the interviews using the motivational approach. According to the TTM developed by Prochaska & DiClemente[12], people engage in behaviors by going through the stages of precontemplation, contemplation, preparation, action, and maintenance.[13]

Only the stages of change were assessed in this study. This model predicts that an individual showing an intended behavior for longer than six months will make it a habit. This phase corresponds to the termination stage, one of the change stages included in the structure of model.[14] the individual TTM-based motivational interviews were carried out with the participants in the study that was planned as a previous phase of the present study. On average, nine interviews were conducted from the date when the individuals were first included in the study to the end of sixth month. The individuals were assessed at the time that they entered the study and immediately after the end of the interview.

Positive improvements were observed in the self-efficacy, metabolic values, and behavioral changes, including use of medicine, nutrition, and physical activity.[8] The durations of studies in the literature conducted on motivational interviews carried out individually showed that these studies were conducted for at most 24 months. The motivational interviews were carried on periodically until the end of these studies.[15,16] In the present study, unlike other studies, the motivational interviews were not continued after the sixth month. Therefore, the aim of this study was to assess whether the effect of a motivational interview on the self-efficacy, metabolic control, and health-behavior change of the individuals with type 2 DM continues at the end of one-year period after they were supported with the indivudual motivational interview. Then, research questions.

Were as follow:

1- Do the self-efficacy scores of participants in the intervention and control groups differ statistically in 18th month?

2- Do the metabolic scores of participants in the intervention and control groups differ statistically in the 18th month?

3- Do the exercise, nutrition and medication use behavior change stages of participants in the intervention and control groups differ statistically in the 18th month?

Materials and methods

The present study is a sub-study of a previous randomized controlled trial.[9] it was conducted at a university hospital in Turkey between July 2015 and November 2016. International Standard Randomised Controlled Trial Number Register (ISRCTN) of previous study: 15662612

The study was performed with the same participants in the previous randomized controlled study.[8] On the basis of the total self-efficacy mean score of the pre-follow-up in a study conducted by Kartal & Özsoy,[17] the sample group size was determined to be 70, with an impact size of 0.34, 90% power, and a 5% margin of error. The individuals in the study sample were assigned to groups by an independent statistician in the computer environment. Computer program randomization placed 35 participants in the intervention group and 35 participants in the control group. This study was conducted with total 32 participants, including 18 from the intervention group and 14 from the control group. In the present study, inclusion and exclusion criteria were not determined and the study was performed with the same participants in the previous randomized controlled trial.[8] Inclusion and exclusion criteria in the previous randomized controlled study were as follows: The inclusion criteria for this study were that participants had T2DM and hypertension or dyslipidemia; were aged between 20 and 65 years; were primary school graduates; had a body mass index (BMI) of 25 kg/m² or more (overweight or obese); had a glycated hemoglobin (HbA1c) level of 7% or more; had T2DM 6 months or longer; and were using oral diabetic medication, insulin, or both. The exclusion criteria were having medical problems that hindered exercise; having serious peripheral or autonomic neuropathy; having severe retinopathy; and having a psychiatric disorder. The flow of participants is shown in Figure 1.
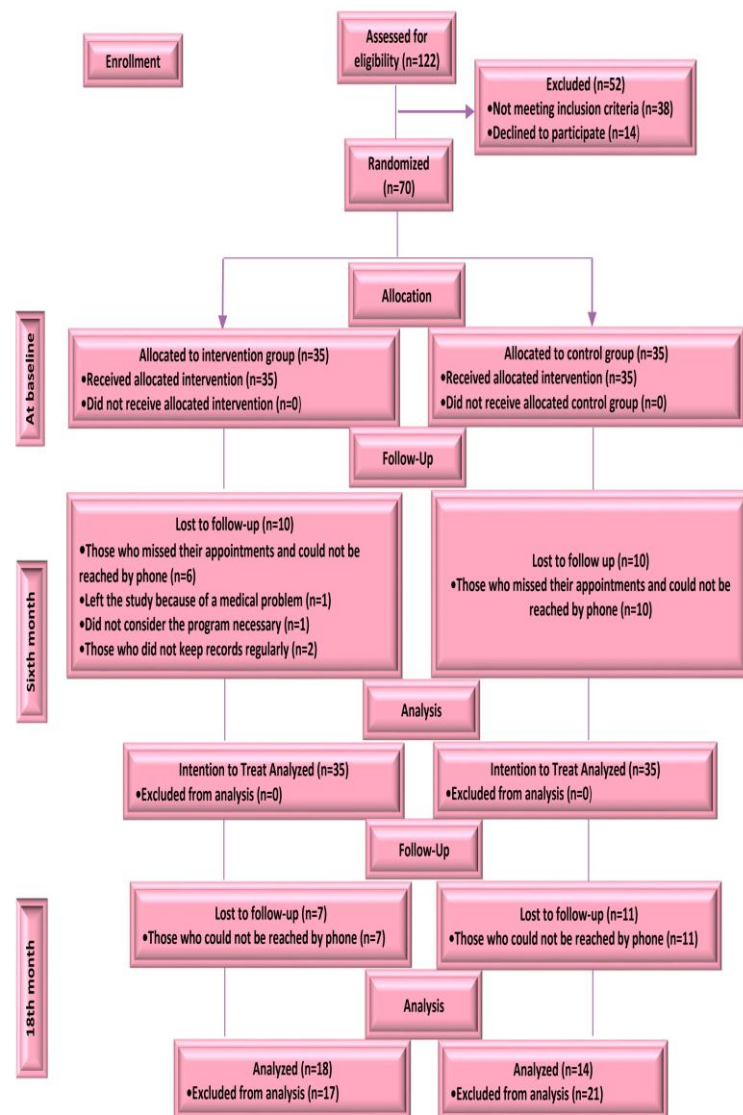

Figure 1. Flow chart of study

This study was conducted according to the principles expressed in the Declaration of Helsinki. Approval was received from the Clinical Research Ethics Committee of the University (No. 2013/14) to conduct this study. The participants were informed according to the Informed Volunteer Consent Form, and their written consents were received. In the present study, the personal information form that was used in the previous randomized controlled trial, the Self-Efficacy (Competence) Scale for Patients with type 2 Diabetes[18,19] and the Diagnosis Form for Behavioral Change Stage in Patients with type 2 Diabetes Mellitus[8] which was prepared by the researcher in accordance with the literature, were used for data collection. The participant information form has five questions about gender, age, education level, and the duration of T2DM. The self-efficacy scale, which focuses on the management of type 2 diabetes, was created by Van der Bijl et al.,[18] in conformance with western culture with the purpose of determining diabetes patients' perceptions of their own power to perform personal care activities. The Cronbach's alpha coefficient of the scale was 0.81. The cross-cultural adaptation of the scale was conducted by Kara et al.,[19] in Erzurum, Turkey; the Cronbach's alpha value of the scale was 0.89, test-retest reliability was 0.91, and its construct validity was 0.80. The factor analysis revealed that the scale explained 52.2% of the total variance.[19]

The scale included 20 items. These items were scored according to a 5-Point Likert type response scale. Kara et al.,[19] conducted the cross-cultural adaptation study of the scale, and found that it had three dimensions. These dimensions were assessment of diet and feet, medical treatment, and physical exercise.[19] The lowest possible score on the scale was 20, and the highest possible score was 100.[18,19] In the general assessment of the scale, patients who scored under the mean score (the general mean score derived from the mean scores of all subdimensions), are assessed as having low self-efficacy, and the patients whose mean scores are above the mean score are assessed as having high self-efficacy.[18]

The health behavior change stage was assessed using the Diagnosis Form for Behavioral Change Stage in Patients with t
ype 2 Diabetes Mellitus, which was prepared by the researcher based on information in the literature[13,20-24] and on the TTM. The researcher consulted six experts (four public health nursing experts, one internal diseases nursing expert, and one statistics expert). The form consisted of three sections: physical exercise, nutrition, and medication use. It included five multiple-choice questions presenting the change stages through which a participant could pass. This form was used in both the intervention and control groups to determine the participants' change stage regarding their physical exercise, nutrition, and medication use.

The participants in the intervention and control groups were contacted by phone in the 18th month after the intervention (at the end of one-year period after the end of individual motivational interviews), and results 18th month of their self-efficacy, metabolic control, and health behaviors were assessed by researcher. The phone was used to fill the instruments. HbA1c, pre-prandial blood glucose, postprandial blood glucose were evaluated in the hospital laboratory when participants went to their routine controls. Height, weight, waist circumference measurements were performed by the diabetes education nurse in the endocrinology and metabolism polyclinic. Results at the beginning and in the sixth month of their self-efficacy, metabolic control, and health behaviors was obtained from previous randomized controlled study.

The primary result was the self-efficacy mean score, which was assessed at the beginning, in the sixth month, and in the 18th month. The secondary results included the metabolic values [height, weight, body mass index, waist circumference, preprandial blood glucose, postprandial blood glucose, HbA1c] and the health-behavioral change stage, which were assessed at the beginning, in the sixth month and in the 18th month. During: intervention of previous randomized controlled study; the TTM-based motivational interview method for this study was developed by the researcher using motivational interview strategies consistent with the TTM's targets and approaches to behavior stages, TTM-based motivational interviews were performed to assess targets and approaches to the nutrition, exercise, and medication use behavior stages of the participants in the intervention group according to the Diagnosis Form for Behavioral Change Stage in Patients with type 2 Diabetes Mellitus. Motivational interview methods such as expressing empathy, developing discrepancy, rolling with resistance, supporting self-efficacy, avoiding giving advice, providing simple decisional balance, using an importance-confidence scale, using open-ended questions, reflecting, and summarizing were used.

Interviews were conducted every 15 days or monthly, at the participants' convenience. Each interview was scheduled to take 30–45 min. These interviews were ended in the sixth month after the baseline interview of the individual. The average of nine interviews were conducted with each individual. During present Study; no intervention was performed on either the intervention group or the control group. Both groups received the usual care, which included diagnostic tests and medical treatment. It was recommended that the participants should come for the control check once every three months if their blood glucose values were in normal range; if not, they should come for the control once every ten days. The training related to the features and use of the insulin prescribed upon the doctor examination was provided by the nurse, who was a diabetes educator.

The data were analyzed using IBM SPSS Statistics 22.0 (IBM Corp. Armong, New York, AB) software. As summary statistics, unit number (n), percentage (%), mean (standard deviation) Mean (SD), median 25th- and 75th-percentile values [median (25%–75%)] were used. The normality distribution of the data was assessed using the Shapiro–Wilk test and the Q-Q plot. For the normally distributed variables, the Independent-Sample t test was used; the Mann-Whitney U and Friedman test were used for the non-normally distributed variables. Categorical

variables were compared using the exact method of Chi-square test. A p-value of less than 0.05 (P<0.05) was considered statistically significant.

Results

The mean age of the participants in the intervention group was 51.83 (7.42) years. Of these participants, 72.2% were female, 55.6% had completed primary school education or lower, and 77.8% had had type 2 DM for more than five years. The mean age of the participants in the control group was 53.78 (6.65) years. Among them, 64.3% were female, 57.1% completed primary school education or lower, and 57.1% had had type 2 DM for more than five years. The groups were similar in terms of the descriptive characteristics (P>0.05) (Table 1).

Table 1. Distribution of descriptive characteristics of participants (n=32)

Descriptive Characteristic	Intervention Group (n=18) Mean (SD)£ Median (%25-%75)	Control Group (n=14) Mean (SD)£ Median (%25-%75)	P
Age (y)	51.83 (7.42)	53.78 (6.65)	0.44¥
HbA1c (%)	8.40 (7.50-9.20)	8.05 (7.37-9.02)	0.71ᵃ
BMI (kg/m2)	38.95 (7.40)	33.31 (4.08)	0.01¥
Self-efficacy scale (total score)	60.72 (6.99)	62.21 (5.57)	0.51¥
Gender€			0.71*
Female	13 (72.2)	9 (64.3)	
Male	5 (27.8)	5 (35.7)	
Educational level€			0.60*
Elementary school or less	10 (56.6)	8 (57.1)	
High school or more	8 (44.4)	6 (42.9)	
Disease duration€			0.26*
≤5 years	4 (22.2)	6 (42.9)	
>5 years	14 (77.8)	8 (57.1)	

¥t- test, ᵃ Mann-Whitney U test, * χ2 test, £mean (standard deviation), €N (%)

The assessment of Self-efficacy intergroup difference in the beginning and the 18th month showed that there was a statistically significant difference only in the medical treatment subscale score (P<0.05). The intergroup difference in the sixth and the 18th month (except for the medical treatment subscale) was statistically significant (P<0.05) (Table 2).

The difference of the Metabolic Values of the intervention group between the follow-ups was statistically significant (P<0.05). The intergroup comparisons in the sixth and 18th month showed that the metabolic values (except for postprandial blood glucose and waist circumference) were statistically significant (P<0.05) (Table 2). About Behavior change stage of nutrition, exercise, and medication use; at the beginning of this phase of the previous randomized controlled study, the groups were similar regarding their nutrition and behavioral stages (P>0.05). According to the sixth-month follow-up of the previous randomized controlled, of the participants in the intervention group, 94.4%, 94.4%, and 94.4% were in the nutrition, the exercise, the use of medicine action stages, respectively, whereas 14.3% of the participants in the control group were in the nutrition, 14.3% were in the exercise and 57.1% were in

the use of medicine action stages; they differed in terms of nutrition, exercise, and the use of medicine behavioral stages according to the sixth-month follow-up (P<0.05). At the 18th-month follow-up, the groups were similar in terms of their nutrition, exercise, and the use of medicine behavioral stages (P>0.05).

Discussion

The importance of this study was its assessment of whether the effect of motivational interview persists on the self-efficacy, metabolic control, and health-behavioral change of the participants with type 2 DM in the 12-month period following the motivational interview. The assessment of one-year follow-up of the participants after the intervention showed that the TTM-based motivational interview had minimal effect on the self-efficacy and metabolic values. Conversely, there was clearly an effect of TTM-based motivational interview apparent in the self-efficacy and metabolic assessments at the end of the sixth month as compared with these values at the beginning of the previous randomized controlled study. We believe that the present study is important in proving that the TTM-based motivational interview should definitely be continued, following its processes after the intervention to enable participants to move to the maintenance stage for the use of medicine, nutrition, and exercise behaviors. The level of self-efficacy is an important concept in the management of chronic diseases.[25] It has been seen as a critical feature in the management of chronic diseases and long-term behavior change.[26] Another study reported that high levels of self-efficacy generates motivation for health-behavioral change, and by contrast, low levels of self-efficacy could be an obstacle to positive health behavior.[27] The present study found that although the self-efficacy levels of the participants in the intervention group (except for the medical treatment subscale score) decreased within the one-year period after the intervention, and the self-efficacy levels of the participants in the control group increased, the intergroup difference in the beginning and in the 18th month was not significant (Table 2).

In a study conducted by Heinrich et al.,[15] (duration of study: 24 months, nurse present, eight motivational interviews during the 24-month period), motivational interviews were continued at certain intervals until the end of the study, as in the present study.

However, that study found that motivational interviews did not make a significant difference between the groups in terms of increasing the self-efficacy score, which was like the results of the present study.

A study conducted to assess the effectiveness of videophone motivational interviews (duration of study: six months, nurse, three videophone motivational interviews during the six-month period) reported that the self-efficacy levels of the interview group were high and that the difference was statistically significant.[28] This result is consistent with the result obtained from the previous randomized controlled trial (duration of study: six months, nurse, nine motivational interviews during

the six-month period) of the present study.[8] However, the self-efficacy level is an important variable in maintaining long-term glycemic control.[29] Therefore, the efficiency of a motivational interview can differ during the period of change in the level of self-efficacy.[28] As a matter of fact, the present study found that both self-efficacy levels and glycemic values showed positive progress in the intervention group during the period in which the motivational interviews were continued, but these self-efficacy and glycemic values fell toward the initial values after the sixth month when the motivational interview was not carried out (Table 2).

The present study also showed that the participants in the control group had HbA1c (<7.0%), preprandial blood glucose (80–130 mg/dl) and postprandial blood glucose (<180 mg/dl) values close to those recommended by American Diabetes Association,[30] in the 18th month after the intervention, but the intergroup difference in the beginning month and the 18th month in terms of the change in HbA1c value in both the intervention and the control groups was not significant (Table 2).

It is suggested that this positive situation in the control group may result from the use of different sources in the disease management (e.g., being affected by the environment and the media). The previous randomized controlled study proved that addressing the behavioral components (nutrition, medicine, and exercise) together in the intervention group within the scope of TTM's conceptual framework from the beginning to the sixth month had a powerful effect on maintaining glycemic control. However, the fact that the participants in the intervention group continued receiving only the usual care during the period after the sixth month caused the glycemic results to be affected negatively. A study in which the motivational interviews were conducted by practitioners (duration of study: 12 months, three motivational interviews) found results that are like the results of the present study.[31] In a two-year randomized controlled trial conducted by Gabbay et al.[16]

The motivational interviews were carried out by the case management nurses, and they were continued in the 12th month after the sixth month and at least once every six months after then. Comparisons with the results of the present study showed that the change in the HbA1c at the end of the sixth month for the intervention group was 1.22% in the present study, whereas Gabbay et al.,[16] found it to be 1.0%. These results suggest that the frequency of motivational interviews is important for improvements in the HbA1c value. A systematic and meta-analytical study reported that motivational interventions had limited effect on blood glucose management, but that attention should be paid to the interpretation of current findings because of heterogeneity issues and the limited number of studies. It was also recommended that the unique contribution of motivational interviews can be better assessed by behavioral change and other intermediate results.[32] A study conducted by Song et al.,[33] reported that the motivational interview in the short term (six months and less than six months) effectively caused a decrease in the

HbA1c level, whereas the effect of motivational interview on the HbA1c level in the long term remained variable. In the present study, weight, body mass index (BMI), and waist circumference which are regarded as an indicator of nutritional behavior, were at normal levels, which then had a positively effect on maintenance of glycemic control. The present study also found that the intergroup difference in the sixth month and the 18th month in terms of weight, BMI, and waist circumference values was significant, and that the motivational interview had effect on weight loss. The participants in the intervention group approached their initial values when they returned to the usual care, and the intergroup difference in the beginning and the 18th month were not found to be significant (Table 2). A study conducted by Rubak et al.,[31] found that there was no difference between the groups in terms of the metabolic values (HbA1c, BMI) of participants in the intervention and control groups, which is similar to the results of the present study. Similar results were also obtained in another study in which the motivational interviews were conducted by healthcare professional (duration of study: 24 months, diabetes nurse-dietician-physiotherapist-psychologist, five motivational interviews in the first year).[34]

However, a systematic review of studies conducting motivational interviews for weight loss showed that 37.5% and 54.2% of the studies reported significant and moderate weight loss, respectively.[35] Another study stated that a motivational interview can be used alone or as an adjunct to other treatments in type 2 DM, particularly for weight control and for other topics related to weight.[36] The previous randomized controlled study found that the motivational intervention increased the level of self-efficacy, and that the high levels of self-efficacy made positive contributions to positive health-behavioral change (nutrition, physical exercise, and the use of medicine action stage), but after the sixth month, the groups were like each other in terms of their nutrition, exercise, and the use of medicine behavioral stages, based on the 18th-month follow-up. The comparison of this result with the result obtained in the previous randomized controlled trial of the present study suggests that the effectiveness of motivational interview on behavior change is important.[8]

A study of 12 months duration reported that the intervention group made more positive progress in the diet and exercise change stages, but their action in the use-of-medicine change stages was at lower levels.[37] A study conducted by Rubak et al.,[38] found that motivation for behavior change and thinking about it improved the beliefs about the treatment and the understanding of type 2 DM among those diabetic patients.

Another study emphasized that the motivational interview had positive effects on the nutrition, medication compliance, and exercise in maintaining DM management.[7] It constitutes the main limitation that the quitted from sample size can be as potential sources of bias. Another limitation of the study is that the measurement tools are filled in by the researcher on the phone.

Table 2. Distribution of the self-efficacy subscales, the self-efficacy total score, and the metabolic values of participants in the intervention and control groups (n=32)

Variables	Intervention Group				Control Group				Comparison of difference between the groups pᵅ (Baseline and 18th month)	Comparison of difference between the groups pᵝ (6th and 18th month)
	At baseline Mean (SD) Median (25%-75%)	Sixth-month follow-up Mean(SD) Median (25%-75%)	18th month follow-up Mean (SD) Median (25%-75%)	P*	At baseline Mean (SD) Median (25%-75%)	Sixth-month follow-up Mean (SD) Median (25%-75%)	18th month follow-up Mean (SD) Median (25%-75%)	P*		
Diet and food control subscale	33.11 (4.54) 32.50 (30.00-34.75)	53.11 (3.90) 54.00 (50.75-56.00)	45.33 (11.49) 42.00 (38.00-51.00)	<0.001	35.00 (3.32) 35.00 (33.50-37.25)	38.85 (2.50) 39.50 (36.00-41.25)	48.50 (15.90) 43.00 (40.50-51.00)	0.001	0.59	<0.001
Medical treatment subscale	17.55 (2.47) 18.00 (15.00-19.25)	23.77 (1.35) 24.00 (23.00-25.00)	24.11 (1.60) 25.00 (23.00-25.00)	<0.001	17.92 (2.70) 18.50 (16.00-20.00)	20.42 (1.65) 20.50 (19.00-22.00)	21.07 (1.68) 21.00 (20.00-22.25)	0.003	0.004	0.627
Physical exercise subscale	10.05 (1.43) 10.00 (9.00-11.00)	13.33 (1.37) 14.00 (12.75-14.00)	11.83 (2.64) 11.50 (9.00-15.00)	<0.001	9.28 (1.48) 9.00 (8.00-10.25)	9.85 (1.65) 10.00 (9.00-11.00)	10.71 (2.16) 10.50 (9.00-13.00)	0.022	0.93	0.02
Total self-efficacy scale score	60.72 (6.99) 60.50 (55.50-65.00)	90.22 (5.39) 91.50 (87.75-95.20)	81.27 (12.39) 77.50 (77.50-95.70)	<0.001	62.21 (5.57) 63.00 (59.50-65.00)	69.14 (4.31) 68.50 (65.75-72.25)	80.28 (15.02) 76.50 (71.50-81.00)	<0.001	0.17	<0.001
Preprandial blood glucose	220.06 (43.02) 224.35 (182.97-247.50)	147.27 (43.21) 134.50 (121.50-157.25)	182.77 (57.01) 171.00 (134.00-246.00)	<0.001	175.52 (58.19) 165.60 (132.50-205.75)	152.78 (61.53) 141.50 (108.00-190.00)	145.00 (36.36) 140.00 (121.25-167.50)	0.11	0.49	0.02
Postprandial blood glucose	299.62 (77.08) 272.50 (238.50-387.00)	191.77 (55.11) 198.50 (150.00-229.00)	201.33 (63.49) 195.50 (144.75-252.75)	<0.001	267.62 (79.78) 259.35 (190.75-332.75)	238.19 (75.29) 244.50 (181.42-270.25)	214.14 (66.31) 209.00 (172.50-238.50)	0.31	0.12	0.27
HbA1c (%)	8.41 (1.03) 8.40 (7.50-9.20)	7.18 (1.09) 6.90 (6.50-7.52)	8.06 (1.15) 7.90 (6.97-9.92)	0.001	8.40 (1.27) 8.05 (7.37-9.02)	7.84 (1.11) 8.15 (6.80-8.82)	7.91 (1.03) 7.70 (7.32-9.00)	0.24	0.76	0.01
Weight (kg)	99.76 (19.90) 99.70 (86.17-108.86)	96.75 (18.82) 97.52 (83.48-104.85)	98.19 (19.93) 96.50 (85.87-108.50)	0.029	81.93 (7.82) 79.52 (76.53-86.25)	81.02 (7.95) 78.62 (74.37-87.45)	80.21 (7.67) 78.00 (72.75-88.25)	0.25	0.80	0.04
BMI (kg/m2)	38.95 (7.40) 38.64 (33.10-43.59)	37.33 (6.19) 38.58 (32.76-41.14)	38.43 (7.42) 37.23 (33.15-42.91)	0.042	33.31 (4.08) 33.80 (29.79-35.45)	32.90 (4.03) 32.77 (30.30-35.20)	32.58 (3.68) 31.79 (30.99-38.67)	0.25	0.76	0.04
Waist circumference	113.58 (12.97) 111.25 (105.75-122.50)	109.94 (12.26) 109.50 (99.75-116.75)	110.72 (12.93) 110.00 (100.00-116.50)	0.003	104.00 (7.10) 103.00 (98.50-108.50)	103.07 (6.13) 101.50 (99.00-108.00)	102.64 (6.19) 102.00 (96.75-109.00)	0.52	0.38	0.43

* Friedman test ᵅMann-Whitney U-test. The comparison of differences at baseline and eighteenth month follow-ups in the intervention and control groups. ᵝMann-Whitney U-test. The comparison of differences at sixth and eighteenth month follow-ups in the intervention and control group

Conclusion

The present study found that the motivational interview increased the self-efficacy level during the one-year period after the intervention compared with the initial values, and the motivational interview also had positive effects on metabolic control and health-behavioral change. The findings of the present study suggest that it is important to maintain the motivational interviews for the use of medications, nutrition, and exercise, all of which are important for management of DM, according to the characteristics of participants at certain intervals during the one-year period after the intervention. High-quality randomized controlled trials with large samples are needed to be conducted for this field. Moreover, it can be suggested that the usual care may not be adequate for the management of DM; supporting this care with psychotherapeutic approaches such as motivational interview is more appropriate and may decrease the number of repetitive hospital check-ups for the participants whose DM management is poor, and consequently, may reduce costs involved in DM treatment.

In this respect, nurses, who play an important role for the protection of health and the prevention of diseases, can exert a positive impact on individuals that encourages them to change their health behaviors. The skills of nurses at the TTM-based motivational interview can be increased to enable the individuals with type 2 DM to adopt and maintain a healthier lifestyle to improve their health outcomes.

Acknowledgments

Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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