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Original Article

Intervention Effect of Mindfulness-Based Cognitive Therapy on Diabetes-Related Distress and Self-Care

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Abstract

Background: Diabetes-related distress (DD) will seriously affect the therapeutic effect of diabetes and the physical and mental health of patients if an intervention treatment is not well implemented. We aimed to explore the effect of mindfulness-based cognitive therapy (MBCT) on the DD level and self-care capability of patients with diabetes.

Method: Sixty-eight patients with type 2 diabetes mellitus (T2DM) were selected from the Department of Endocrinology in Jinhua People's Hospital, China and divided into control (CG) and intervention (IG) groups. Routine diabetes health education (RDHE) was only carried out in the CG, whereas the RDHE and MBCT were provided to the IG. Repeated ANOVA measurements were adopted to investigate the intergroup differences of these two intervention therapies on improving the DD and self-care capability of patients with diabetes.

Results: RDHE and MBCT could relieve the DD level of patients with diabetes, but the DD value in IG was lower than that in CG. In comparison with RDHE, MBCT and RDHE could significantly improve the diet and exercise dimensions of patients, and such improvement effects were significantly sustaining (P<0.05). MBCT and RDHE exerted better effects than RDHE alone on blood glucose testing, foot care, and medication intake. However, these effects were not sustaining.

Conclusion: The care and medication guide provided by MBCT consultants and medical staff can significantly relieve the patients' DD and enhance their self-care capability. As a low-cost psychological intervention therapy with good sustaining effects, MBCT is important to strengthen the therapeutic effect on diabetes and lowering the medical cost.

Keywords: Mindfulness-based cognitive therapy; Diabetes-related distress; Self-care; Intervention effect; Mental health

Introduction

Diabetes is a metabolic disease caused by defects in the insulin secretion of patients. By extending the treatment course of this disease, patients may be susceptible to complications in eyes, kidneys, heart and blood vessels, and nervous system, accompanied by increased probability of intensive treatment with insulin. Consequently, 60%–70% of patients with diabetes will suffer

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diabetes-related distress (DD) at different extents, thereby seriously affecting the therapeutic effect on diabetes (1). According to the International Diabetes Federation, the number of diagnosed patients with diabetes globally has reached 450 million in 2017. In the same year, four million people have died of diabetes, and the medical expenditure has reached $727 billion and presented a yearly growth trend. The number of diagnosed patients with diabetes may rise to 693 million in 2045 (2). If patients are not provided with mental intervention for improved self-care capability, the therapeutic effect on diabetes and patients' living qualities will be seriously affected, which will aggravate social medical burden (3-5).

If provided by medical care personnel, routine diabetes health education (RDHE) can enhance the self-care behaviors of patients with diabetes. After the RDHE intervention, the DD value of patients is evidently reduced, and their blood glucose level is improved (6). Self-care is a highlighted theme in the RDHE intervention. The DD value of patients with diabetes suffering severe mental distress is evidently lowered after the RDHE intervention (7). As a low-cost therapy with favorable mental intervention effect, the mindfulness-based cognitive therapy (MBCT) has been initially applied to the mental intervention therapy for the DD of patients in recent years. For instance, a randomized controlled trial showed that MBCT can markedly mitigate the negative emotions of patients with diabetes at a certain sustaining level, but no evident improvement effect is manifested on the DD of patients (8). The mental intervention effects of MBCT and cognitive-based therapy were compared and showed that both therapies can effectively remit the DD of patients (9). According to clinical observation, MBCT can improve the self-care behaviors of patients with diabetes in terms of HbA1c control, diet, exercise, and meditation (10).

Different opinions are held over whether MBCT can possibly relieve the DD level of patients for the following reasons (1). Mindfulness originates from Buddhism, which owns a longer history and stronger social basis in the Orient than in the West (2). MBCT aims to strengthen the self-care capability of patients with diabetes. Otherwise, the relieving effect on the DD level of patients will be restricted. A total of 68 patients with type 2 diabetes mellitus (T2DM) were selected in Eastern China and were examined to explore whether MBCT can significantly enhance the self-care capability of patients and relieve their DD level if implemented in oriental countries. RDHE was administered in CG during hospitalization, whereas MBCT and RDHE were administered in IG. Next, the DD level of patients was measured using the diabetes distress scale (DDS), and their self-care capability was measured using diabetes self-care activities (DSCA) (11). Experiments were carried out at three time points, i.e., upon hospitalization (T1), upon hospital discharge (T2), and one month after discharge (T3). At each time point, the DD and DSCA values of patients in both groups were measured. On this basis, the intergroup (CG and IG) effects of DDS and DSCA at different time points were explored via repeated ANOVA measurements to analyze their intergroup differences in improving the DD and self-care capability of patients by using RHDE and MBCT interventions.

We aimed to explore the effect of mindfulness-based cognitive therapy (MBCT) on the DD level and self-care capability of patients with diabetes.

Materials and Methods

Ninety-seven patients were enrolled from hospitalized patients with T2DM from January to June 2021 in the Inpatient Department of Endocrinology, Jinhua People's Hospital, China.

This study was approved by the Ethic Committee of Jinhua People's Hospital (approval No: IRB-2020002-R).

Seventy-six samples were selected after excluding those with other serious diseases (e.g., cancer) and mental diseases. A total of 38 patients were included into CG and provided with RDHE. The other 38 patients were included into IG and

provided with RDHE + MBCT. In the process of implementing MBCT, 8 patients quit halfway, and 68 cases (26 males and 42 females) were included into this research. A total of 30 samples (11 males and 19 females) in IG and 38 samples (17 males and 21 females) in CG were included.

Seventeen variables, i.e., age, course of the disease, educational background, marital status, annual household income, insulin application, oral administration of hypoglycemic drugs, number of complications, medical insurance level, body mass index, HbA1c (%), systolic blood pressure, diastolic blood pressure, triglyceride level, total cholesterol level, low-density lipoprotein cholesterol level, and high-density lipoprotein cholesterol level, were selected and measured when the patients were admitted to hospital (Table 1).

Table 1: Statistical characteristics of the demographic and biochemical indicators of all samples

Variable		*Total samples (n = 68)*	*Variable*		*Total samples (n = 68)*
Age (yr)		57.76 ± 7.50	Education	Illiterate	6
Course (yr)		9.87 ± 3.25	Level	Literate	23
BMI (kg/m²)		23.90 ± 2.62	Marital	Married	32
HbA1c (%)		8.46 ± 0.84	status	Separated	7
SBP (mmHg)		120.17 ± 11.33		Unmarried	6
DBP (mmHg)		79.12 ± 5.86		Widowed	23
TG (mmol/L)		1.58 ± 0.42		Divorced	32
TC (mmol/L)		4.89 ± 1.42	Annual	< 3000	6
LDL-C (mmol/L)		3.32 ± 1.13	income	3000–5000	23
HDL-C (mmol/L)		1.12 ± 0.87	($/year)	5000–10 000	32
Insulin Injection		42		> 10 000	7
Oral hypoglycemic drug administration		26	Medical insurance	High	26
Diabetic complications	0	26	level	Middle	42
	≥ 1	26		Low	26

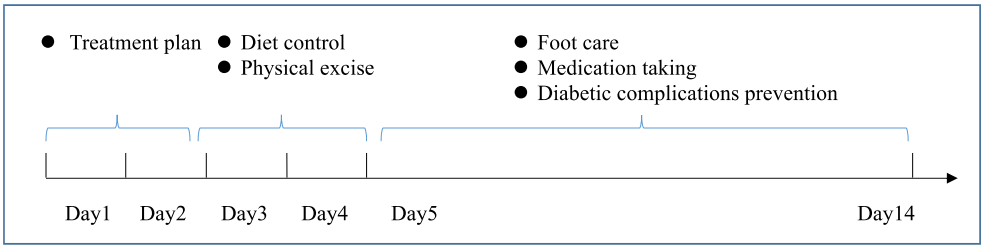
Research Methods

The research process was divided into three time points, i.e., upon hospitalization (T1), upon hospital discharge (T2), and one month after discharge (T3), to explore whether MBCT would significantly improve the patients' DD level and self-care capability. The patients in CG were only intervened by using RDHE at T2, whereas MBCT was added based on RDHE in IG at T2. The concrete proposal was as follows:

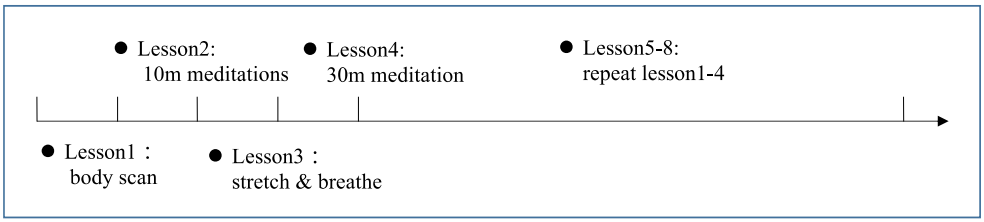
1) CG: At 1–2 days after hospitalization, patients were informed with the basic matters needing attention (e.g., safety protection, medical examination, and medication intake and treatment plan) during hospitalization. At days 3–4, patients were told about relevant knowledge, like diet control and exercise. At days 5–14, foot care knowledge, usage of insulin, and complication prevention notes were introduced to patients. The above knowledge was highlighted once again upon hospital discharge, ensuring that patients could use insulin correctly. The experimental process in CG is shown in Fig. 1 (a).

2) IG: Besides RDHE, the MBCT course was provided to patients in the health education room in the Department of Endocrinology (twice per week for two weeks, 1–2 h each time), and the teachers were certified MBCT consultants. In the first class, MBCT-related knowledge and exercise essentials were introduced, and patients were guided to complete the body scanning. In the second class, patients were asked to sit quietly for a 10 min meditation. In the third class, patients completed stretching and respiratory training under guidance. In the fourth class, patients were

guided to complete 30 min meditation. In the 5th–8th classes, previous training was repeated, ensuring that the patients could carry out MBCT by themselves after hospital discharge. The experimental process in IG is shown in Fig. 1 (b).



(a) RDHE intervention process for control group



(b) RDHE+MBCT intervention process for intervention group

Fig. 1: Experimental processes for control and intervention groups at T2

Statistical analysis

SPSS ver. 22.0 (IBM Crop., Armonk, NY, USA) was utilized for statistical analysis in this study. To evaluate the statistical differences of variables between CG and IG groups, *t* test was employed for the comparisons of BMI, HbA1c, SBP, DBP, TG, TC, LDL-C and HDL-C, DDS, diet, exercise, blood glucose testing, foot care). $\chi 2$ test was used for the comparisons of age, education level, course, marital status, annual income, insulin injection, oral hypoglycemic drug administration, diabetic complications, and medical insurance level. Statistically significant differences were suggested if $P<0.05$.

Before conducting the baseline comparison, some statistical preprocesses were conducted on the DDS and self-care-capability dimensions, as follows:

1) Statistical preprocess on DDS scale. The DDS scale was adopted to measure the patient's DD level (12). The DDS scale was translated into Chinese, and it showed satisfying reliability and validity (Cronbach's α = 0.897, KMO = 0.924). The DDS values of patients in CG and IG were measured at T1, T2 and T3. Fisher Distress Evaluation Criteria (FDEC) was adopted to distinguish the patient's DD levels: DDS < 2.0 meant no distress, DDS = 2.0–3.0 indicated moderate distress, and DDS > 3.0 denoted severe distress (3).

2) Statistical preprocess on Self-care capability. The DSCA scale was adopted to measure the patient's self-care capability (11). The DSCA scale was translated into Chinese, and it showed reliability and validity in four dimensions, which are diet, exercise, blood glucose monitoring, and foot care (with the Cronbach's α coefficients were 0.82, 0.92, 0.89, and 0.62, respectively). The Cronbach's α coefficients for the medication intake and smoking were not calculated, because there was only one question item in each dimension.

Results

Nine demographic statistical variables (like age) and eight biochemical statistical variables (like BMI) of the patients in CG and IG were collect-

ed at T1 (before intervention). The comparative calculation results of intergroup baseline values were presented in Table 2 and 3, respectively. Revealed by the results of repeated ANOVA measurements, no significant differences were found in these variables. This result indicated the comparability on these seventeen variables between two groups.

Table 2: Baseline Level Comparison of Demographic Statistical Variables of Samples at T1 ($\overline{x} + s$)

Variable		*Control group*	*Intervention group*	χ^2	*P*
Age (yr)		58.82 ± 7.57	56.43 ± 7.31	0.718	0.401
Course (yr)		9.68 ± 3.20	10.10 ± 3.35	−1.116	0.168
Education level	Illiterate	16	10	0.427	0.842
	Literate	22	20		
Marital status	Married	26	19	0.761	0.862
	Separated	3	2		
	Unmarried	2	1		
	Widowed	6	6		
	Divorced	1	2		
Annual income ($/year)	< 3000	4	2	3.261	0.265
	3000–5000	12	11		
	5000–10 000	17	15		
	> 10 000	5	2		
Insulin injection		22	20	1.623	0.281
Oral hypoglycemic drug administration		16	10	1.779	0.362
Diabetic complications	0	16	10	3.218	0.221
	≥ 1	22	20		
Medical insurance level	High	16	10	1.253	0.652
	Middle	22	20		
	Low	16	10		

Table 3: Intergroup Baseline Level Comparison of Statistical Biochemical Indicators of Samples at T1 ($\overline{x} + s$)

Variable	*Control group*	*Intervention group*	*t*	*P*
BMI (kg/m²)	23.85 ± 2.74	23.96 ± 2.51	−0.896	0.130
HbA1c (%)	8.40 ± 0.82	8.54 ± 0.87	−0.657	0.256
SBP (mmHg)	120.82 ± 10.99	119.36 ± 11.88	0.253	0.106
DBP (mmHg)	78.42 ± 5.49	80.02 ± 6.27	0.639	0.313
TG (mmol/L)	1.57 ± 0.30	1.54 ± 0.43	−0.266	0.438
TC (mmol/L)	5.07 ± 1.57	4.53 ± 1.32	0.827	0.185
LDL-C (mmol/L)	3.44 ± 1.29	3.28 ± 1.10	0.077	0.272
HDL-C (mmol/L)	1.16 ± 0.81	1.08 ± 0.92	−0.531	0.231

The DDS and self-care levels (dependent variables) of the patients in CG and IG were collected at T1 (before intervention). As not sufficient sample size was reported on the "smoking" dimension (only six patients smoke), comparative calculation were carried out on the rest six dimensions (i.e., DDS, Diet, Exercise, Blood glucose testing, Foot care and Medication intake). The results of repeated ANOVA measurements are presented in Table 4, which showed the following two findings:

1) No statistical difference was observed in the baseline (before intervention) DDS values between CG and IG. Among the two groups, 52 patients suffered from moderate or severe diabetes-related distress (29 cases in CG and 23 cases in IG).

2) No statistically differences were found in the baseline (before intervention) values in five self-care dimensions (i.e., Diet, exercise, Blood glucose testing, Foot care, and Medication intake) between two groups.

Combining the results in Table 3 and 4, the samples selected in the two groups were suitable and comparable for the intervention effect analysis.

Table 4: Baseline Level Comparison of Dependent Variables of Samples ($\overline{x} + s$)

Dependent Variable	*Control group (CG)*	*Intervention group (IG)*	*t*	*P*
DDS	2.69 ± 0.45	2.75 ± 0.33	−0.561	0.723
Diet	3.21 ± 0.81	3.25 ± 0.69	0.162	0.817
Exercise	3.01 ± 2.03	3.10 ± 2.26	−0.357	0.638
Blood glucose testing	2.72 ± 2.14	2.91 ± 1.89	−0.492	0.721
Foot care	2.47 ± 1.89	2.73 ± 2.72	−0.868	0.241
Medication intake	4.70 ± 1.96	4.62 ± 1.83	0.523	0.652

According to the intervention processes described in Fig.1, RDHE was implemented in CG, while RDHE+MBCT was implemented in IG. Values of the variables in Table 4 were measured for the patients in two groups at T2 and T3. Values in Table 4 were the baseline, collected at T1 (before intervention). Comparative calculations were conducted to investigate the interventions effects of MBCT on the patients' DD levels and self-care capabilities in IG against CG. The results are shown in Table 5.

1) DDS: After the RDHE + MBCT, the patients' DDS levels in IG at T2 and T3 showed significant improvement when compared with the baseline values at T1 (P_{T2}, $P_{T3} < 0.001$). Although the mean of DDS level in IG at T3 was higher than that in T2, there was still significant difference between T1 and T3, and it indicated that MBCT had sustaining effect on relieving the patients' DD even after hospital discharge. Compared with CG, the patients' DDS level in IG was lower and was statistically different from that in CG. All results above indicated that MBCT could significantly relieve the patient's DD level with sustaining effect when the discharge from hospital for a month.

2) Diet and exercise: Significantly improvement in these two dimensions on the patients in IG at T2 and T3 were observed in comparison with those at T1 (P_{T2}, $P_{T3} < 0.001$). Similar findings were found for the patients in CG where only RDHE intervention was adopted at T2. Howev-

er, these patients' diet and exercise were not significantly improved at T3 ($P_{T3} > 0.05$), which indicated that RDHE had no sustaining effects on improving patients' diet and exercise. Compared with those in CG, the diet and exercise levels in IG at T2 and T3 were significantly improved ($P < 0.001$).

3) Blood glucose testing, foot care, and medication intake: Both patients in two groups in the three dimensions at T2 were significantly improved compared with those at T1 ($P_{T2} < 0.05$), but were not significantly improved at T3 ($P_{T3} > 0.05$). Furthermore, no significant differences were found between two groups at T2 and T3. However, the mean values of these three dimensions in IG was higher than those in CG, which indicated that MBCT had a better intervention effect than RDHE.

Table 5: Baseline Level Comparison of Dependent Variables of Patients in Two Groups at Different Time Points ($\bar{x} + s$)

Dependent Variable	*Time*	*Control group (CG)*	*Intervention group (IG)*	*t*	*P*
DDS	T1	2.69 ± 0.45	2.75 ± 0.33	−0.561	0.723
	T2	2.31 ± 0.33**	1.92 ± 0.22***	−6.218	0.000
	T3	2.55 ± 0.51	1.98 ± 0.43***	−8.233	0.000
Diet	T1	3.21 ± 0.81	3.25 ± 0.69	0.162	0.817
	T2	3.62 ± 0.55**	3.95 ± 0.72***	2.782	0.016
	T3	3.37 ± 0.71	3.51 ± 0.66***	3.221	0.000
Excise	T1	3.01 ± 2.03	3.10 ± 2.26	−0.357	0.638
	T2	3.42 ± 1.29**	4.90 ± 1.72***	2.992	0.006
	T3	3.15 ± 2.27	4.71 ± 2.04***	3.793	0.000
Blood glucose testing	T1	2.72 ± 2.14	2.91 ± 1.89	−0.492	0.721
	T2	3.33 ± 2.55**	3.61 ± 1.01**	1.582	0.183
	T3	2.83 ± 1.69	3.83 ± 1.89**	4.323	0.027
Foot care	T1	2.47 ± 1.89	2.73 ± 2.72	−0.868	0.241
	T2	4.09 ± 2.19***	3.93 ± 1.97***	0.712	0.135
	T3	3.72 ± 1.68	3.16 ± 2.33	2.291	0.032
Medication intake	T1	4.70 ± 1.96	4.62 ± 1.83	0.523	0.653
	T2	5.37 ± 1.61**	5.27 ± 1.37**	1.293	0.526
	T3	4.73 ± 1.08	4.92 ± 1.29	3.258	0.001

**P<0.05, ***P<0.001

Discussion

Intervention effect analysis of MBCT on DD

The study showed that the MBCT could be served as a beneficial intervention in addition to RDHE. It did not show significant improvement in relieving patients' DD and enhancing their self-care capabilities with certain sustaining effects in some dimensions.

1) RDHE could significantly relieve the patients' DD levels during their hospitalization. This finding was similar to the conclusion drawn in another study (13), because all patients felt less distressed when their blood glucose levels restored to normal at T2. However, RDHE could not sustainingly relive the DD levels of the patients in CG after hospital discharge, because there were no significant intergroup difference between T1 and T3. This finding could be attributed to the

fact that the RDHE intervention during hospitalization helped the patients to master diabetes-related knowledge and enhanced their self-care capability to some extent, but this knowledge did not significantly relieve their mental distress, and hence, the DD levels of patients in CG quickly restored to original state when they were admitted to hospital (T1).

2) Compared with RDHE, MBCT could not only significantly relive the DD levels of the patients during hospitalization (T2), but also sustainingly lower their DD levels after discharge (T3). The mean DDS value of IG was higher at T3 than that at T2, but was still significantly lower than that at T1. The mean DDS values in IG at T2 and T3 were consistently lower than those in CG. What's more, 23 patients with moderate distress in IG were transformed into mild stress level at T2 and T3. These findings in this study were similar to the conclusions drawn by the other two studies (9,10), but were slightly different from the findings in Van Son's study (8). The main reason could be attributed to the fact that, China has thousands of years of Buddhist culture; Chinese patients were much easier to accept the embedded Buddhist ideas in MBCT than those who believed in Christ in western countries (8). It was much easier for the MBCT consultants to persuade the Chinese patients to accept psychologically and get along with the distress, and hence, improving the patients' mindfulness levels and in turn reliving their mental distress.

Intervention effect analysis of MBCT on the self-care capability of patients

1) The self-care capability of the patients in IG in two dimensions, i.e., diet and exercise, at T2 and T3 was significantly enhanced with sustaining effects by additionally implementing MBCT. The intergroup differences in the two dimensions were also significant, indicating that MBCT could better improve the diet and exercise controls of patients than implementing RDHE alone. This finding showed that the body scanning of MBCT enabled the patients to perceive the exercise details with mind and enjoy the exercise actively but not just passively complete the exercise on some purpose (15).

2) Compared with CG, the patients in IG with RDHE + MBCT intervention, were significantly different in three dimensions, i.e., blood glucose testing, foot care, and medication intake, at T2 and T3. However, no sustaining effect of MBCT was found on these dimensions. Because there were no significant intergroup differences between CG and IG. The reasons were as follows. First, both patients in the two groups consciously tested their blood glucose levels, and the currently advanced glucometer had already considerably reduced the testing troubles faced by patients. Second, MBCT did not exert any significant sustaining improvement in the foot-care dimension because the foot care process was troublesome, which aggravated the psychological resistance of patients in both groups. Third, similar finding was observed in the medication-intake dimension. Because even if the patients were repeatedly guided to use insulin by the medical staff, many of them were still failed to use it correctly. However, compared with the CG, MBCT facilitated the patients in IG to use insulin with more patience, and hence, strengthening their capability to master the usage of insulin.

Limitations

There are two limitations in this study. First, the therapeutic effect of MBCT on patients in IG group was tested only for a month after hospital discharge, while a longer testing period should provide more evidence whether the MBCT has a sustaining effect on relieving the patients' DD levels. Second, this study did not touch the mechanism of how MBCT influences the patients' self-care capabilities, which needs to be further studied.

Conclusion

This study reveals that the MBCT implemented in IG can significantly lower the DD level of T2DM patients with certain sustaining effects on some dimension. The diet control and exercise in

IG are sustainably improved at a significant level. Compared with those in CG, the self-care capabilities of patients in IG in blood glucose testing, foot care, and medication intake are significantly strengthened, but the effect is not significantly sustaining. To enhance self-care activities, patients with diabetes are encouraged to 1) further seek for help from MBCT consultants to consolidate the DD relieving and sustaining effects, and 2) actively consult medical staff in foot care and insulin usage. This study shows that MBCT can evidently mitigate the DD level of patients with T2DM and strengthen their self-care capabilities. In addition, MBCT, a low-cost psychological intervention therapy, has evident social welfare.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declared that they have no competing interests.

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