Effect of individualized diabetes education for type 2 diabetes mellitus: a single-center randomized clinical trial.

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Abstract

Background: To evaluate the effect of individualized education for patients with type 2 diabetes mellitus (T2DM).

Methods: A total of 280 patients (158 males, mean age 63 ± 10 years) with T2DM were randomly divided into study and control group. Eysenck Personality questionnaire was used to assess the personality of the patients in the study group, which was provided us one-on-one counseling and individualized management plan. Group education was provided to the control group.

Results: At the end of the study, the body mass index (21.5 ± 2.5 vs 23.6 ± 1.6 kg/m^2, P =0.002), waist circumference (83.7 ± 6.4 vs 85.7 ± 7.7 cm, P =0.03), fasting blood glucose (6.0 ± 0.8 vs 6.9 ± 2.1 mmol/L, P =0.004), HbA1c ($6.2\pm0.6\%$ vs $6.9\pm3.1\%$, P =0.03), systolic blood pressure (130.1 ± 8.8 vs 135.1 ± 8.4 mmHg, P =0.003), triglyceride (1.21 ± 0.66 vs 1.46 ± 0.58 mmol/L) and low-density lipoprotein (2.36 ± 0.44 vs 2.84 ± 0.64 mmol/L, P =0.03) in the study group was lower than in the control group.

Conclusion: Individualized diabetes education is more effective than group education in facilitating the control of type 2 diabetes.

Keywords: Individualization; type 2 diabetes; health education; blood glucose; blood pressure.

Introduction

Diabetes education plays a pivotal role in the management of type 2 diabetes mellitus (T2DM). Recent clinical trials have confirmed that diabetes education significantly improved the percentage of patients achieving therapeutic targets, and increased medication adherence and self-care performance.[1,2] Diabetic education was also associated with a lower rate of chronic complications from the chronic illness[1] In patients with T2DM, personality traits seem to be associated with the level of glycemic control.[3] High neuroticism scores were associated with a higher level of glycosylated haemoglobin (HbA1c) concentrations in patients with T1DM.[4] A recent meta-analysis showed that adverse psychosocial factors, such as stress-prone personality or coping style, were associated with poor control of type 1 and type 2 diabetes.[5] Stress management training was associated with a clinically significant reduction in HbA1c[6] Furthermore, experimental data suggested that interventions based on the personality of the individuals improved the success of the diabetes treatment.[7]

Most current diabetes education programs are knowledge based and have emphasis on lifestyle changes, self-care and active participation in disease management.[1,2,8] These education sessions were often delivered to a group of patients.[1,2,8] There is little information about the effect of individualized and personality specific diabetes education on the management outcomes of T2DM. In the present study, we evaluated the clinical outcomes of a group of

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T2DM patients who received an individualized diabetes education program taking into consideration their personality traits.

Patients and methods
Patient selection
This study was approved by the institutional review board of our hospital. Written informed consent was obtained from all participants before the study. Between October 2008 and October 2010, 365 hospitalized patients with T2DM were screened for this study.

The selection criteria were: a) Established diagnosis of T2DM according to the 1999 World Health Organization diagnostic criteria; b) Able to participate follow-up studies after discharge; c) Provision of written informed consent. Exclusion criteria were: a) Known psychological or psychiatric disorders, such as major depression or generalize anxiety disorders; b) Severe co-morbidities, such as renal failure, hepatic dysfunction, cancer or stroke; c) Uncontrolled complications from diabetes, such as acidosis, infection, peripheral vascular disease resulting amputation or leg ulcer.

Eighty-five patients were excluded from this study due to inability to attend regular follow-ups (n =54) or severe complications from diabetes (n =31). The general characteristics of the 280 enrolled patients (158 males, mean age 63±10 years) are listed in table 1.

Table 1. Comparison of baseline data between the study and control group.

	Study （n=138）	Control （n=138）	*P*
Age (yrs)	62.94±10.72	64.89±10.14	0.26
Sex (male)	78(56.5%)	80(58.0%)	0.34
Education level			
Primary	80 (58.0%)	88(63.7%)	0.71
High school	32(23.2%)	28(20.3%)	0.69
Tertiary	26(18.8%)	22(15.9%)	0.58
Duration of DM (yrs)	11.4 ± 4.8	11.6 ± 5.0	0.66
BMI (kg/m^2)	24.25±3.71	24.32±3.89	0.76
Waist circumference (cm)	86.9±6.01	86.7±6.22	0.78
Fasting blood glucose (mmol/L)	8.60±3.02	8.72±3.39	0.95
Post-prandial glucose (mmol/L)	13.72±4.91	13.93±4.56	0.63
HbA1c	9.61±1.92	9.80±1.98	0.38
SBP(mm Hg)	142.38±17.55	139.82±15.99	0.46
DBP(mm Hg)	86.18±10.80	87.93±11.63	0.41
Triglyceride (mmol/L)	1.41±0.91	1.43±0.80	0.95
LDL(mmol/L)	3.20±0.80	3.16±0.79	0.69
HDL(mmol/L)	1.20±0.20	1.43±0.25	0.29
Total cholesterol(mmol/L)	4.88±0.82	4.78±0.67	0.63

BMI: Body mass index. SBP and DBP: systolic and diastolic blood pressure; LDL and HDL: low and high density lipoprotein.

Personality assessment

The personality in the study group was assessed by Eysenck Personality Questionnaire.[9]

For practical purposes of this study, a patient's personality is classified into one of the following 4 categories: stable extraversion (outgoing, talkative, responsive and easygoing); unstable extraversion (touchy, restless, excitable, changeable or impulsive); stable introversion (calm, even-tempered, reliable, controlled, peaceful, thoughtful, careful, and passive); and unstable introversion (quiet, reserved, pessimistic, sober, rigid, anxious, or moody).

Diabetes education

Eight practicing nurses underwent a 2-week training course on diabetes education and Eysenck Personality Questionnaire assessment. A written evaluation was conducted at the end of the training course to ensure all the nursing educators were familiar with the education and personality assessment protocols.

Individualized education was provided to the study group patients by face-to-face counseling over one hour, based on the personality of the patient. The patient's knowledge on diabetes and self-care was assessed, and a tailored self-care plan was provided to each patient after the counseling. These plans were jointly developed by the nursing educators and a clinical psychologist in our hospital, covering dietary modification, exercises programs, adherence to medications, self-monitoring of blood glucose and blood pressure, and psychological counseling based on the four sub-groups of patients. In patients with stable extraversion personality, the education was focused on the importance of self-care plans, and adherence to medications. Patient's family members were encouraged to help with the monitoring of medication adherence. In patients with unstable extraversion personality, a more directive approach was used in identification of issues in self-care and management plans, and very specific therapeutic targets were set. In patients with stable introversion personality, a detailed explanation of the pathogenesis of diabetes, actions of medications and use of self-monitoring devices (e.g. home glucose monitor) were provided to address patient's concerns and queries. Patients with unstable introversion personality often showed lack of motivation in participating self-care and monitoring plans, therefore the education focus was to help them to understand the potential complications form sub-optimal diabetes management, thus motivating their participation of the management.

After the discharge, at the end of each calendar month, a follow-up was conducted in our hospital clinics for all patients, for a total of 6 months (Fig 1). At the middle of each calendar month (approximately two weeks before the hospital visit), a 10-min telephone interview was conducted by the nursing educators to all patients to address any issues or concerns the patients might have. All patients were invited to attend 3-monthly forum in the education facilities of our hospital. On the forum patients were encouraged to exchange views and ideas on diabetes self-care and discuss their progress in the management. The 2-h forums were facilitated by the nursing educators and a clinical psychologist who also addressed patients' concerns and questions.

With control group patients, one-hour face-to-face education sessions were provided in small groups (4-5 patients) during hospitalization. These education sessions were conducted by the same group of nurses who delivered the education sessions to the study group. The content of the education was mainly on the general information on diabetes, dietary and life style modification, correct use and compliance of anti-diabetic medications and self-monitoring of blood sugar levels. No personality assessment was performed, and no individualized self-care plan was provided (Fig 1). The after-discharge monthly follow-ups and monthly telephone interviews were conducted in the same manner as in the study group. A 3-monthly education forum was also provided to all patients but no personality based counseling by a clinical psychologist was provided during these forums.

Assessment of management outcomes

Clinical examination was performed at each follow-up visits and laboratory tests were performed when clinically deemed necessary during each hospital visits. In each patient, the body mass index, waist circumference, blood pressure, fasting and post-prandial blood glucose, and blood lipid profile were assessed at the end of the 6-month study.

Statistical analysis

SPSS v13.0 was used for the statistical analysis. Quantitative variables are expressed as mean $\pm$ SD. Comparison of numerical data was performed by a paired student t test. Fisher's exact test was used for the comparison of categorical data. $P < 0.05$ was considered statistically significant.

Results
General findings
In the study group, the number of patients with stable extraversion, unstable extraversion, stable introversion and unstable introversion personality was 55(37.1%), 12(8.1%), 54(36.5%), and 27(16.2%), respectively. Two patients from the study group (1.4%) and two from the control group (1.4%, P >0.05) did not complete the 6-month follow up and were subsequently excluded from this study (Fig 1).
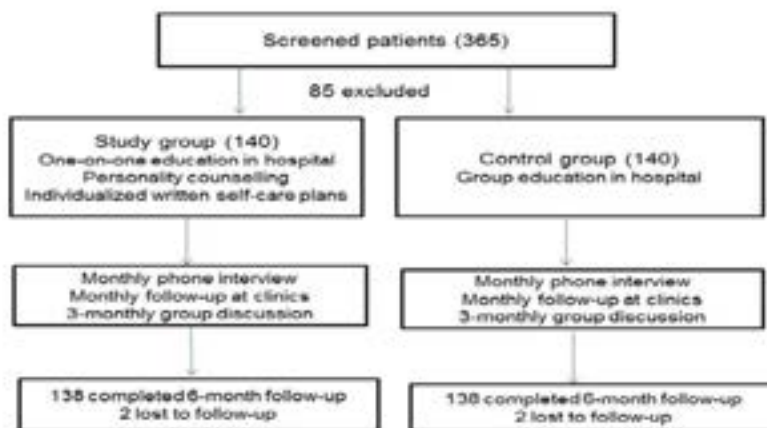

Figure 1. Flow chart of patient recruitment, randomization and follow-up

As shown in table 1, there was no statistically significant difference in age, sex, education level, duration of the T2DM, complications fromT2DM between the two groups before the study (P >0.05). The baseline body weight, blood glucose andlipids profile were also similar between the two groups (P >0.05).

Comparison of the clinical and biochemical outcomes
The body mass index, waist circumference, fasting and post-prandial blood glucose, HbA1c, blood pressure, triglycerides and low-density lipoprotein in the study and control group six months after the intervention are listed in table 2.

Table 2. Comparison of clinical and biochemical outcomes between study and control group

	Study（n=138）	Control（n=138）	P
BMI (kg/m^2)	21.5±2.4	23.6±1.5	0.002
Waist circumference (cm)	83.7±6.4	85.7±7.7	0.032
Fasting blood glucose (mmol/L)	6.01±0.76	6.93±2.13	0.004
Post-prandial glucose (mmol/L)	7.52±1.54	8.82±1.32	0.048
HbA1c	6.21±0.56	6.95±3.12	0.027
SBP(mm Hg)	130.1±8.8	135.1±8.4	0.003
DBP(mmHg)	80.1±10.3	82.6±8.8	0.082
Triglyceride (mmol/L)	1.21±0.66	1.46±0.58	0.037
LDL(mmol/L)	2.36±0.44	2.84±0.64	0.032
HDL(mmol/L)	1.21±0.14	1.40±0.19	0.22
Total cholesterol(mmol/L)	4.26±0.76	4.44±1.23	0.038

BMI: Body mass index. SBP and DBP: systolic and diastolic blood pressure; LDL and HDL: low and high density lipoprotein.

Within each group, compared with the baseline value, there was a statistically significant reduction in body mass index, waist circumference, fasting and post-prandial blood glucose, systolic and diastolic blood pressure at the end of the trial (P <0.01). There was also a reduction in total cholesterol, triglyceride and low-density lipopro-tein at the end of the study (P <0.01). However, the level of high-density lipoprotein in each group remained unchanged (P >0.05).
At the end of the trial, the body mass index, waist circumference, fasting and postprandial blood glucose and HbA1c in the study group were lower than in the con-

trol group (table 2, P <0.05 or <0.01). The systolic blood pressure, triglyceride, low-density lipoprotein and total cholesterol in the study group were also lower than in the control group (table 2, P <0.05 or <0.01). There was no statistically significant difference in the mean diastolic blood pressure and high-density lipoprotein between the two groups (table 2, P >0.05).

Discussion

The main findings of the present study are that in comparison with group education, individualized diabetes education tailored to patients' personality was associated with a greater reduction in fasting and post-prandial blood glucose. Individualized diabetes education was also associated with a greater reduction in body weight index, waist circumference, systolic blood pressure and blood cholesterol.

The association between patients' personality and diabetes control appears complex and controversial. A previous clinical trial found that lower average blood glucose values at baseline were associated with higher scores for neuroticism and several specific traits including anxiety, angry hostility, depression, self-consciousness, and vulnerability.[3] One explanation for these relations between personality and blood sugar level was that people with higher neuroticism scores are more prone to experience negative emotions, which may provide increased motivation for a patient to follow self-care regimen and achieve a better clinical outcome.[3]

However, another study found that high neuroticism scores were associated with a higher level of glycosylated haemoglobin concentrations in patients with T1DM.[4] Patients with "dramatic-dependent" personality had a poor metabolic control.[10] Taken together, adverse psychosocial factors and personality traits may be associated with poor control of diabetes, probably through poor adherence to therapeutic regimens including life style modifications.[5] In the present study, we divided the study group patients into four personality categories, and provided one-on-one counselling and individualized self-care plans to each patient. This was reinforced by a monthly clinic visit and a monthly telephone interview. After 6 months of intervention, the fasting and postprandial blood glucose levels and HbA1c in the study group were lower than in the control group. The body mass index, waist circumferences, systolic blood pressure and blood triglyceride

or low-density lipoprotein levels in the study group were also lower than in the control group. These results suggest that in patients with T2DM, individualized education programs taking into consideration the personality of the patients are associated with better management outcomes than group education alone.

The reasons for the improved outcomes in the study group may be multifactorial. The individualized education or counseling, together with a written self-care plan based on the patient's personality, may have improved patients' motivation in adhering to dietary and life style modification measures. This is supported by a greater reduction in body weight mass index and waist circumferences, which are known to facilitate blood glucose, cholesterol and blood pressure control in diabetics.[11,12] Furthermore, a recent study demonstrated that the diabetes knowledge was closely associated with medication adherence and good glycemic control.[13] Although medication adherence was not assessed in the present study, it is likely that the individualized education and self-care plans may have improved patients' adherence to hypoglycemic and cardiovascular medications, which in turn led to a better blood glucose, blood pressure and lipids control.

It is worth noting that there was also a statistically significant reduction in blood glucose, HbA1c, blood pressure and cholesterol in the control group at the end of this study. These results suggest that group education with regular follow-ups is effective and should be considered as part of the integrated management plans for T2DM. However, in a primary health setting, the effect of group education on diabetes control seems uncertain. A structured group education program for patients with newly diagnosed T2DM resulted in greater improvements in weight loss and smoking cessation, but made no significant difference in HbA1c levels 12 months or 3 years after the intervention.[14,15] The lack of long-term effect on blood glucose control in these reports was probably related to the nature of education programs which were offered as a one-off short course.[14,15] In our study, education sessions for the control group commenced during hospitalization, and were reinforced by monthly follow-ups and three-monthly forum discussions. Our findings are supported by other studies that regular education programs every 3 months were associated with persistent clinical, psychological and cognitive improvements in patients with T2DM.[16,17]

Conclusion

Regular education programs in patients with T2DM are associated with improved blood glucose control, and reduction in cardiovascular risk factors such as body mass index, blood pressure and cholesterol. Individualized education programs incorporating personality of the patients seem to offer better management outcomes than group education alone.

Conflict of interest

None to declare.

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