Am J Transl Res 2022;14(6):3946-3954
www.ajtr.org /ISSN:1943-8141/AJTR0138531

Original Article

Positive effect of cognitive-behavioral intervention combined with integrated health care on patients with type 2 diabetes

Wei Jin[1*], Qiumin Wu[2*], Zhiwei He[3], Yilan Fu[1]

[1]Department of Endocrinology, Hainan General Hospital, Hainan Affiliated Hospital of Hainan Medical University, Haikou 570311, Hainan, China; [2]Department of Outpatient, Hainan Cancer Hospital, Haikou 570311, Hainan, China; [3]Department of Radiology, Hainan Cancer Hospital, Haikou 570311, Hainan, China. [*]Equal contributors and co-first authors.

Received August 24, 2021; Accepted April 30, 2022; Epub June 15, 2022; Published June 30, 2022

Abstract: Objective: This study was designed to investigate the effects of cognitive-behavioral intervention (CBI) combined with integrated health care (IHC) on glycemic control, adverse mood, health knowledge and self-efficacy in patients with type 2 diabetes mellitus. Methods: The clinical data of 115 patients with type 2 diabetes mellitus were retrospectively collected and divided into two groups according to the intervention methods, with 57 patients in group A receiving conventional care and 58 patients in group B receiving CBI combined with IHC. The blood glucose, scores of Hamilton Depression Rating Scale (HAM-D), Hamilton Anxiety Rating Scale (HAM-A), health knowledge, self-efficacy, quality of life, and nursing satisfaction were compared between the two groups before and after intervention. Results: Compared with group A, group B had lower glycated hemoglobin (HbAlc), 2-h postprandial glucose (2 hPG), and fasting plasma glucose (FPG) levels ($P < 0.05$), lower HAMD and HAMA scores ($P < 0.05$), higher health knowledge and self-efficacy scores ($P < 0.05$), and higher quality of life after intervention ($P < 0.05$). Group B exhibited a nursing satisfaction rate of 94.83%, higher than that of 70.18% in group A ($P < 0.05$). Conclusion: The effects of CBI combined with IHC can effectively control blood glucose and improve dysphoria, health knowledge, self-efficacy, and quality of life in patients with type 2 diabetes.

Keywords: Type 2 diabetes mellitus, cognitive-behavioral intervention, integrated health care, glycemic control, dysphoria, health knowledge, self-efficacy

Introduction

With the rapid increase in elderly population, the number of patients with chronic diseases, including diabetes mellitus, has been increasing significantly [1]. Type 2 diabetes, also known as adult-onset diabetes, is a common type of diabetes. Its onset is closely related to various factors such as lifestyle, race, age, environment, and genetics [2, 3]. Poor glycemic control can easily damage target organs, cause complications such as diabetic nephropathy and retinopathy, and seriously affect the quality of life of patients [4].

Studies have shown that glycemic control is closely related to patients' disease knowledge and lifestyle [5, 6]. Due to different education levels and ages, some patients with type 2 diabetes seriously lack the knowledge and understanding of the disease, have low treatment compliance, and usually cannot follow medical advice on medication strictly, making it difficult to achieve glycemic control [7, 8]. In order to achieve effective blood glucose control, it is necessary to strengthen health education for patients. In addition, diabetic patients are at high risk for psychological disorders due to the lifelong need to take medication [9]. Studies have shown that 30-50% of patients with type 2 diabetes have symptoms of depression, and about 40% experience anxiety [10, 11]. Compared with ordinary diabetic patients, diabetic patients with anxiety or depressive symptoms tend to have poor glycemic control and low self-management ability, facing a significantly higher risk of complications.

Health education is a systematic, organized, and planned social education, which can lead people to adopt healthy lifestyles and behaviors voluntarily [12]. Health education is traditionally carried out by nurses, and physicians are not involved. In contrast, integrated health care (IHC) connects physicians, nurses and patients, and implements health education through their cooperation [13]. Behavioral therapy is considered to be a psychological intervention that corrects maladaptive cognitions by changing beliefs, mind, and behavior, helping to eliminate undesirable behaviors and emotions [14]. Although health education and cognitive-behavioral therapy have been applied in some clinical settings, there are relatively few studies on their combined effects in patients with type 2 diabetes [15, 16]. This study was designed to explore the effects of cognitive-behavioral intervention (CBI) combined with IHC on glycemic control, adverse mood, health knowledge and self-efficacy in patients with type 2 diabetes.

Materials and methods

Clinical data

The clinical data of 115 patients with type 2 diabetes mellitus were retrospectively analyzed and divided into two groups, with 57 patients in group A receiving conventional care and 58 patients in group B receiving CBI combined with IHC. This study was approved by the Medical Ethics Committee of Hainan General Hospital, Hainan Affiliated Hospital of Hainan Medical University (approval number NCT025-68317). (1) Inclusion criteria: signed informed consent was obtained from patients or their families; patients with good communication skill; those who met the diagnostic criteria for type 2 diabetes in the Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes (2017 edition); type 2 diabetes had been diagnosed for more than 6 months; no other serious organic diseases of heart, liver, and kidney. (2) Exclusion criteria: withdrawal midway; comorbid with severe mental disorder or somatic dysfunction; patients who were taking anti-anxiety or antidepressant medication with possible psychological effects; patients with drug or alcohol dependence; patients with malignant tumors; and patients who were unwilling to participate in the research.

Methods

Patients in group A were instructed to strengthen diet and exercise, and health education was provided, that is, nursing staff explained disease knowledge to patients through pictures or videos, *etc*.; patients were told to strictly follow medical advices.

Patients in group B received CBI and IHC in addition to the measures performed in group A.

CBI was performed in three stages: (1) Stage 1 (cognitive intervention and behavior correction): In the first week, the treatment process was explained to the patients. Patients started to get to know medical staff and learnt about disease-related knowledge, including pathogenesis, risk factors, treatment methods, *etc*., so as to reduce the strangeness and psychological pressure of patients. In the second week, nursing staff listened to the patients carefully, understood the psychological state of each patient, found out the specific reasons for the occurrence of adverse emotions, expressed understanding and concern for the patients, answered every question raised by the patients patiently and meticulously, built a good nurse-patient relationship, and gained the trust of patients. In the third week, patients' bad behaviors and habits were corrected, diet exercise interventions were formulated, and patients were instructed to quit smoking and drinking. In the fourth week, patients were guided to relax through meditation, progressive muscle relaxation and pranayama, which were first demonstrated by professionals and then practiced by the patients. (2) Stage 2 (relaxation training): During week 5 to 7 of intervention, patients were guided to relax repeatedly through meditation, progressive muscle relaxation, and pranayama, and were instructed to practice 20-30 min before bedtime every day. (3) Stage 3 (summary and analysis): At week 8 of intervention, patients were guided to review all sessions, and their questions about each session were collected and resolved through group discussion. For the unimproved psychological conditions, patients were encouraged to make psychological preparations and discuss the treatment of relapse. During the intervention, patients could communicate with medical staff through various methods, such as Weibo, email or phone.

Integrated health education. (1) Establishment of a special education group: A special integrated medical, nursing and patient education group was formed by the responsible nurse, attending physician, endocrinologist, head nurse of the ward, and director of the department. The attending physician was responsible for evaluating the patient's condition and tracking the patient's blood glucose and vital data. The endocrinologist was responsible for making flexible adjustments to the patient's blood glucose control regimen; the head nurse of the ward was mainly responsible for coordinating the workflow and organizing a weekly summary meeting for the group members; the director of department was responsible for guiding and regularly checking the quality of the team's work. The standardized training was provided for the members of the group, and a unified assessment was conducted after the training. The training included the basic knowledge of diabetes, including the pathogenesis, diet, exercise, common complications, and the correct use of blood glucose meters, *etc*. It was also necessary to strengthen the training of insulin pump to ensure that each medical staff could master the application of insulin pump. (2) Work flow and content: After admission of the patient, the attending physician made a comprehensive assessment of the patient's condition, collected the baseline data, and formulated a targeted health education program on basis of the condition. A diabetes health education video was produced, including awareness of diabetes, control of blood sugar, *etc*. After watching the video, patients could consult an endocrinologist if they did not understand or had concerns or doubts. The endocrinologist would answer patiently and adjust the glucose lowering regimen flexibly according to the actual condition of the patients. A group discussion was held every week, in which members discussed the shortcomings and obstacles occurred during health education and proposed measures to achieve continuous quality improvement. The daily blood glucose levels of the patients were analyzed with a chart, so that patients could understand their results of blood glucose control intuitively and improve the enthusiasm towards treatment.

Outcome measurement

Primary indicators

Blood glucose level: Before and after intervention, glycated hemoglobin (HbAlc), 2-h postprandial glucose (2 hPG), and fasting plasma glucose (FPG) levels of the two groups were measured using a fully automatic biochemical analyzer (Keegan Biotechnology Co., Ltd.).

Adverse mood [17]: Before and after intervention, the scores of Hamilton Depression Rating Scale (HAMD) and Hamilton Anxiety Rating Scale (HAMA) were used to evaluate adverse mood in both groups. HAMD scores < 7, 7-17, 17-24, and > 24 indicated normal, probably depressed, definitely depressed, and severely depressed, respectively. HAMA scores ≥ 29, ≥ 21, ≥ 14, ≥ 7, and < 7 indicated severe anxiety, significant anxiety, definite anxiety, mild anxiety, and no anxiety, respectively.

Health knowledge scores [18]: Before and after intervention, the health knowledge scores of both groups were evaluated using the Diabetes Knowledge Questionnaire compiled by Chinese Diabetes Education Project Group, including complications, exercise, diet, medication, blood glucose monitoring, and general knowledge, with a score range of 0-30. The level of diabetes knowledge was directly proportional to the score.

Self-efficacy scores [19, 20]: Before and after intervention, the self-efficacy of patients was evaluated using the General Self-Efficacy Scale (GSES), including 10 items, with a score range of 10-40, and the self-efficacy was proportional to the score.

Secondary indicator

Quality of life scores [21]: Before and after intervention, the quality of life of both groups was evaluated using the Quality of Living Scale (QOL-BREF), including social, environmental, physical and psychological areas, with a score range of 0-26 points, and the quality of life was directly proportional to the score.

Nursing satisfaction: After nursing, the self-made nursing satisfaction questionnaire was used for both groups to investigate the satisfaction categorized as very satisfied, basically satisfied and dissatisfied. Very satisfied + basically satisfied = total satisfaction.

Statistical methods

SPSS22.0 was used for data analysis. Measurement data were described as mean ±

Table 1. Comparison of baseline data [n (%)]/($\bar{x}$±sd)

Data		Group A (n = 57)	Group B (n = 58)	t/χ^2	*P*
Gender (cases)	Male	38 (66.67)	41 (70.69)	0.216	0.642
	Female	19 (33.33)	17 (29.31)		
Age (years)		68.59 ± 5.63	68.61 ± 5.61	0.019	0.985
Duration of disease (years)		9.19 ± 1.18	9.21 ± 1.12	0.093	0.926
Educational level (cases)					
Primary school and below		25 (43.86)	22 (37.93)	0.617	0.893
Junior high school, high school		12 (21.05)	15 (25.86)		
Secondary school, college		10 (17.54)	12 (20.69)		
Bachelor's degree and above		10 (17.54)	9 (15.52)		
Co-morbidities (n)					
Coronary heart disease		13 (22.81)	14 (24.14)	0.187	0.911
Hypertension		11 (19.30)	13 (22.41)		
Hyperlipidemia		16 (28.07)	15 (25.86)		

standard deviation, independent-samples *t* test was performed for inter-group comparison, and paired t test was performed for intra-group comparison. Count data were described as [n (%)], and χ^2 test was used for inter-group comparison. Rank sum test was used for ranked data. P < 0.05 suggested the presence of statistical significance.

Results

Comparison of baseline data

There was no significant difference in baseline data such as gender, age, educational level, and comorbid diseases between the two groups (P > 0.05) (**Table 1**).

Comparison of glycemic control between the two groups

There was no significant difference in the levels of HbAlc, 2 hPG, and FPG before intervention between the two groups (P > 0.05). Compared with those before intervention, the levels of HbAlc, 2 hPG, and FPG were lower in both groups after intervention (P < 0.05). Compared with group A, the levels of HbAlc, 2 hPG, and FPG were lower in group B after intervention (P < 0.05) (**Figure 1**).

Comparison of adverse mood between the two groups

There was no significant difference in HAMD and HAMA scores between the two groups before intervention (P > 0.05). Compared with those before intervention, the HAMD and HAMA scores were lower in both groups after intervention (P < 0.05). Compared with group A, the HAMD and HAMA scores were lower in group B after intervention (P < 0.05) (**Figure 2**).

Comparison of health knowledge and self-efficacy between the two groups

There was no significant difference in health knowledge and self-efficacy scores between the two groups before intervention (P > 0.05). Compared with those before intervention, health knowledge and self-efficacy scores were higher in both groups after intervention (P < 0.05). Compared with group A, health knowledge and self-efficacy scores were higher in group B after intervention (P < 0.05) (**Figure 3**).

Comparison of quality of life between the two groups

There was no significant difference in quality of life scores between the two groups before intervention (P > 0.05). Compared with those before intervention, quality of life scores were higher in both groups after intervention (P < 0.05). Compared with group A, quality of life scores were higher in group B after intervention (P < 0.05) (**Figure 4**).

Comparison of nursing satisfaction between the two groups

In group A, there were 21 very satisfied patients, 19 basically satisfied patients, and 17 dissatisfied patients, with the total nursing

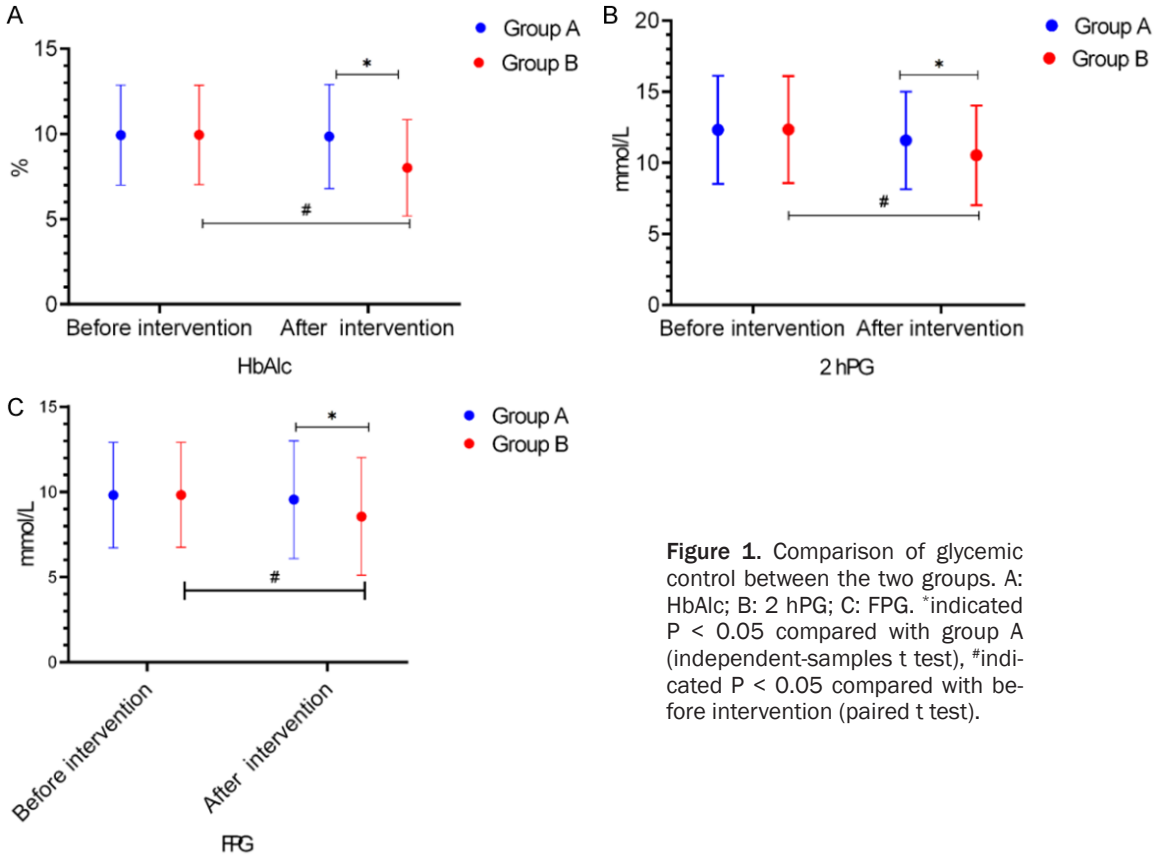

Figure 1. Comparison of glycemic control between the two groups. A: HbAlc; B: 2 hPG; C: FPG. *indicated P < 0.05 compared with group A (independent-samples t test), #indicated P < 0.05 compared with before intervention (paired t test).

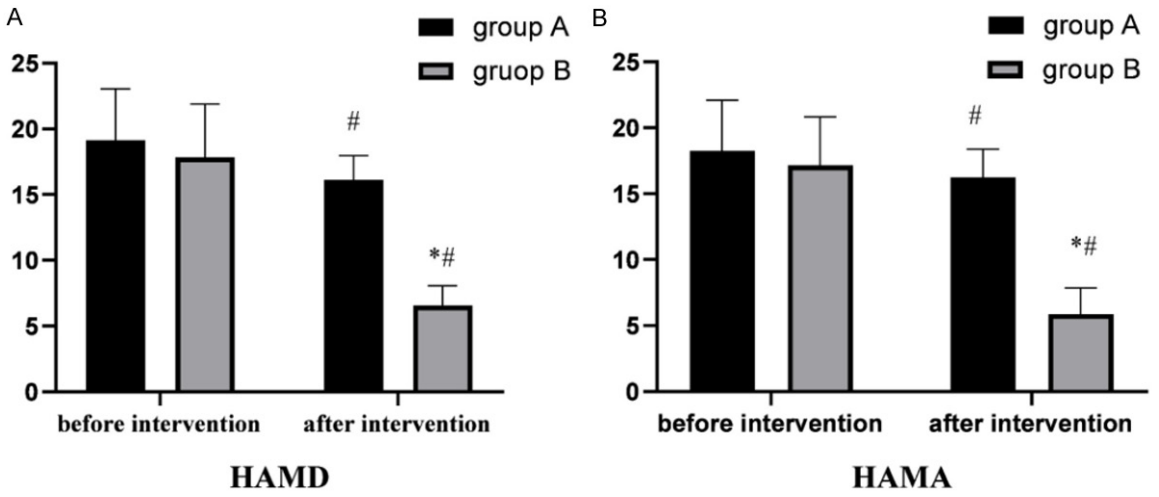

Figure 2. Comparison of adverse mood. A: HAMD score; B: HAMA score. *indicated P < 0.05 compared with group A (independent-samples t test), #indicated P < 0.05 compared with before intervention (paired t test).

satisfaction rate of 70.18%, while in group B, there were 32 very satisfied patients, 23 basically satisfied patients, and 3 dissatisfied patients, with the total nursing satisfaction rate of 94.83%, which was higher than that in group A (P < 0.05) (**Table 2**).

Discussion

Type 2 diabetes is a systemic disease that causes a variety of functional or structural changes in organs and tissues, reducing the quality of life of patients [22]. Due to the lack

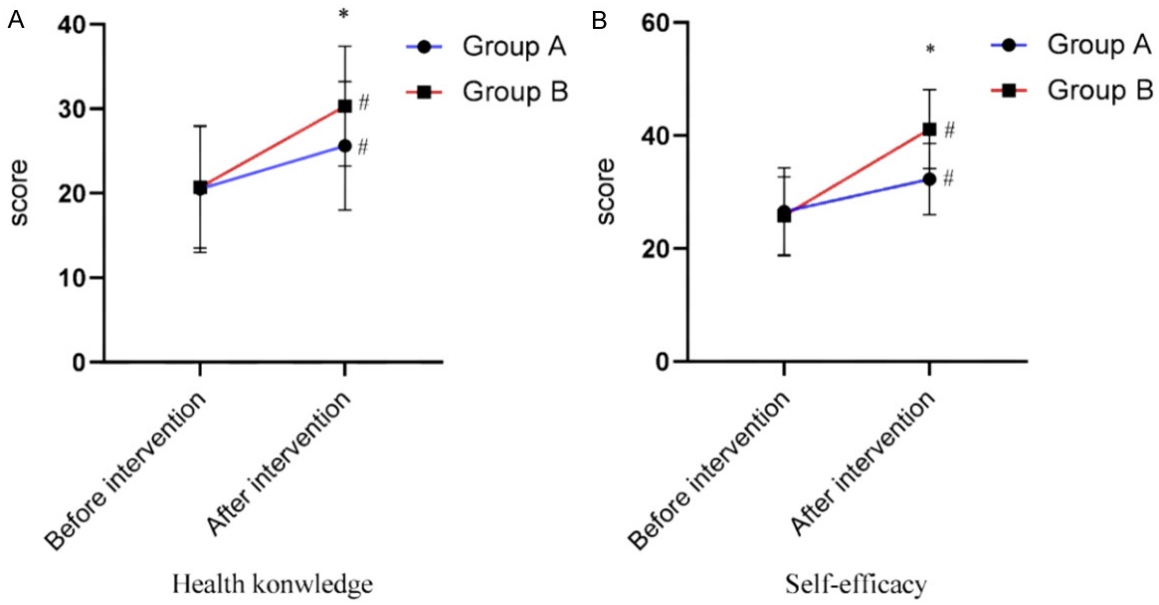

Figure 3. Comparison of health knowledge and self-efficacy. A: Health knowledge scores; B: Self-efficacy scores. *indicated P < 0.05 compared with group A (independent-samples t test); #indicated P < 0.05 compared with before intervention (paired t test).

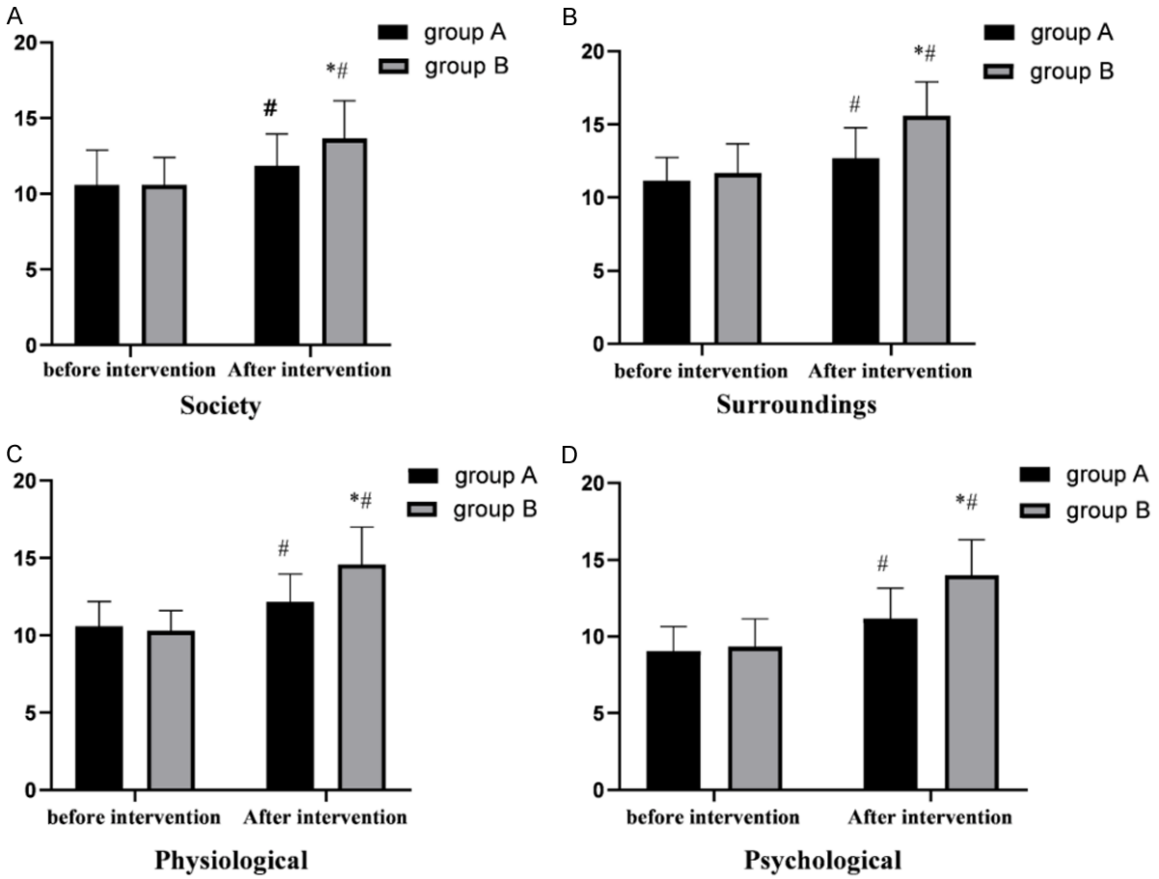

Figure 4. Comparison of quality of life. A: Social scores; B: Environmental scores; C: Physiological scores; D: Psychological scores. *indicated P < 0.05 compared with group A (independent-samples t test), #indicated P < 0.05 compared with before intervention (paired t test).

Table 2. Comparison of nursing satisfaction [n (%)]

Group	Number of cases	Very satisfied	Basically satisfied	Dissatisfied	Total satisfaction
Group A	57	21 (36.84)	19 (33.33)	17 (29.82)	40 (70.18)
Group B	58	32 (55.17)	23 (39.66)	3 (5.17)	55 (94.83)
χ^2	-	-	-	-	12.161
P	-	-	-	-	< 0.001

of disease knowledge and the need for lifelong medication, most patients are highly susceptible to adverse emotions such as anxiety and depression [23]. This study performed a CBI combined with IHC for patients with type 2 diabetes. The results of this study showed that the measured blood glucose indices in group B were lower than those in group A after intervention, suggesting that CBI combined with IHC could improve the effect of blood glucose control. The reason may be that long-term high levels of blood glucose can cause a series of adverse mood. IHC focused on cooperation among physicians, nurses and patients, and a targeted treatment regimen was formulated according to the condition. Nursing staff strictly followed the physician's instructions to provide treatment guidance and health education for patients, the head nurse regularly checked the implementation of various tasks, and the director of department carried out the overall supervision and instruction to the treatment. Through the cooperation between physicians and nurses, the patient's blood sugar level was effectively controlled [24, 25].

Depression and anxiety are common psychological problems in patients with type 2 diabetes, which seriously affect the prognosis, reduce the quality of life of patients, and increase the incidence of diabetic complications [26]. The results of this study showed that patients in group B had lower HAMD and HAMA scores and higher quality of life scores and nursing satisfaction than group A after intervention, suggesting that CBI combined with IHC in patients with type 2 diabetes could improve adverse mood, quality of life and nursing satisfaction. Cognitive-behavioral model was implemented in three stages in terms of cognitive interventions, behavior correction and relaxation training. The specific reasons for the occurrence of adverse mood was found out by assessing the cognitive status and psychological condition of patients and building a good nurse-patient relationship, gaining the trust of patients, correcting the bad behavior and habits of patients, guiding the patient through meditation, progressive muscle relaxation and pranayama, so as to achieve the purpose of relieving adverse emotions. When the psychological state of patients is improved, their quality of life and nursing satisfaction are also improved [27]. In addition, in this study, group B had higher health knowledge and self-efficacy scores than group A after intervention, demonstrating the effectiveness of CBI combined with IHC in patients with type 2 diabetes, which facilitates the improvement of health knowledge and self-efficacy of patients. Ma et al. [28] also found that the implementation of integrated health education in the elderly patients with diabetes could significantly improve the self-management ability of patients, and master health knowledge, which has important clinical significance to improve the prognosis of elderly diabetes patients. This is consistent with the results of this study. The underlying reasons may be that after combining medical care with patient education, medical and nursing staff implemented targeted treatment and care for patients and flexibly adjusted the glucose-lowering regimen, which deepened patients' knowledge and understanding of glycemic control. Secondly, the daily blood glucose values were plotted as data graphs, which was convenient for patients to intuitively understand their own blood glucose and improve the enthusiasm of blood glucose control. The medical and nursing staff patiently answered various questions raised by patients and combined with CBI to reduce adverse emotions of patients and improve their psychological state, thus increasing the treatment confidence of patients and improving their self-efficacy [29].

In conclusion, the CBI combined with integrated health education in patients with type 2 diabetes can effectively control blood glucose and improve adverse mood, health knowledge, self-efficacy as well as quality of life scores of patients.

Although this study concluded that CBI combined with integrated health education could improve treatment efficacy in patients with type 2 diabetes, the results of the study need to be validated with a larger sample size. At the same time, this study has few indicators, which should be improved in future studies.

Disclsoure of conflict of interest

None.

Address correspondence to: Yilan Fu, Department of Endocrinology, Hainan General Hospital, No. 19 Xiuhua Road, Xiuying District, Haikou 570311, Hainan, China. Tel: +86-0898-68622226; E-mail: 327211763@163.com

References

[1] Saslow LR, Mason AE, Kim S, Goldman V, Ploutz-Snyder R, Bayandorian H, Daubenmier J, Hecht FM and Moskowitz JT. An online intervention comparing a very low-carbohydrate ketogenic diet and lifestyle recommendations versus a plate method diet in overweight individuals with type 2 diabetes: a randomized controlled trial. J Med Internet Res 2017; 19: e36.

[2] Wang LL, Wang Q, Hong Y, Ojo O, Jiang Q, Hou YY, Huang YH and Wang XH. The effect of low-carbohydrate diet on glycemic control in patients with type 2 diabetes mellitus. Nutrients 2018; 10: 661.

[3] Dunlay SM, Givertz MM, Aguilar D, Allen LA, Chan M, Desai AS, Deswal A, Dickson VV, Kosiborod MN, Lekavich CL, McCoy RG, Mentz RJ and Piña IL. Type 2 diabetes mellitus and heart failure: a scientific statement from the American Heart Association and the Heart Failure Society of America: this statement does not represent an update of the 2017 ACC/AHA/HFSA heart failure guideline update. Circulation 2019; 140: e294-e324.

[4] Soderlund PD. Effectiveness of motivational interviewing for improving physical activity self-management for adults with type 2 diabetes: a review. Chronic Illn 2018; 14: 54-68.

[5] Atallah R, Côté J and Bekarian G. Evaluation of the effects of a nursing intervention on the therapeutic adherence of people with type 2 diabetes. Rech Soins Infirm 2019; 136: 28-42.

[6] Caruso R, Magon A, Baroni I, Dellafiore F, Arrigoni C, Pittella F and Ausili D. Health literacy in type 2 diabetes patients: a systematic review of systematic reviews. Acta Diabetol 2018; 55: 1-12.

[7] Cai H, Li G, Zhang P, Xu D and Chen L. Effect of exercise on the quality of life in type 2 diabetes mellitus: a systematic review. Qual Life Res 2017; 26: 515-530.

[8] Chiang SL, Heitkemper MM, Hung YJ, Tzeng WC, Lee MS and Lin CH. Effects of a 12-week moderate-intensity exercise training on blood glucose response in patients with type 2 diabetes: a prospective longitudinal study. Medicine (Baltimore) 2019; 98: e16860.

[9] Zhao WT, Luo Y, Zhang Y, Zhou Y and Zhao TT. High protein diet is of benefit for patients with type 2 diabetes: an updated meta-analysis. Medicine (Baltimore) 2018; 97: e13149.

[10] Qaseem A, Wilt TJ, Kansagara D, Horwitch C, Barry MJ, Forciea MA, Fitterman N, Balzer K, Boyd C, Humphrey LL, Iorio A, Lin J, Maroto M, McLean R, Mustafa R and Tufte J. Hemoglobin A1c targets for glycemic control with pharmacologic therapy for nonpregnant adults with type 2 diabetes mellitus: a guidance statement update from the American College of Physicians. Ann Intern Med 2018; 168: 569-576.

[11] Selçuk-Tosun A and Zincir H. The effect of a transtheoretical model-based motivational interview on self-efficacy, metabolic control, and health behaviour in adults with type 2 diabetes mellitus: a randomized controlled trial. Int J Nurs Pract 2019; 25: e12742.

[12] Yang L, Shao J, Bian Y, Wu H, Shi L, Zeng L, Li W and Dong J. Prevalence of type 2 diabetes mellitus among inland residents in China (2000-2014): a meta-analysis. J Diabetes Investig 2016; 7: 845-852.

[13] Or CK, Liu K, So MKP, Cheung B, Yam LYC, Tiwari A, Lau YFE, Lau T, Hui PSG, Cheng HC, Tan J and Cheung MT. Improving self-care in patients with coexisting type 2 diabetes and hypertension by technological surrogate nursing: randomized controlled trial. J Med Internet Res 2020; 22: e16769.

[14] Al-Mrabeh A, Hollingsworth KG, Shaw JAM, McConnachie A, Sattar N, Lean MEJ and Taylor R. 2-year remission of type 2 diabetes and pancreas morphology: a post-hoc analysis of the DiRECT open-label, cluster-randomised trial. Lancet Diabetes Endocrinol 2020; 8: 939-948.

[15] Tanase-Nakao K, Arata N, Kawasaki M, Yasuhi I, Sone H, Mori R and Ota E. Potential protective effect of lactation against incidence of type 2 diabetes mellitus in women with previous gestational diabetes mellitus: a systematic review and meta-analysis. Diabetes Metab Res Rev 2017; 33: e2875.

[16] Saunders T. Type 2 diabetes self-management barriers in older adults: an integrative review of the qualitative literature. J Gerontol Nurs 2019; 45: 43-54.

[17] Brown SA, García AA, Brown A, Becker BJ, Conn VS, Ramírez G, Winter MA, Sumlin LL, Garcia TJ

and Cuevas HE. Biobehavioral determinants of glycemic control in type 2 diabetes: a systematic review and meta-analysis. Patient Educ Couns 2016; 99: 1558-1567.

[18] Thiel DM, Al Sayah F, Vallance JK, Johnson ST and Johnson JA. Association between physical activity and health-related quality of life in adults with type 2 diabetes. Can J Diabetes 2017; 41: 58-63.

[19] Ojo O, Weldon SM, Thompson T, Crockett R and Wang XH. The effect of diabetes-specific enteral nutrition formula on cardiometabolic parameters in patients with type 2 diabetes: a systematic review and meta-analysis of randomised controlled trials. Nutrients 2019; 11: 1905.

[20] Hou YY, Ojo O, Wang LL, Wang Q, Jiang Q, Shao XY and Wang XH. A randomized controlled trial to compare the effect of peanuts and almonds on the cardio-metabolic and inflammatory parameters in patients with type 2 diabetes mellitus. Nutrients 2018; 10: 1565.

[21] Dyson PA, Twenefour D, Breen C, Duncan A, Elvin E, Goff L, Hill A, Kalsi P, Marsland N, McArdle P, Mellor D, Oliver L and Watson K. Diabetes UK evidence-based nutrition guidelines for the prevention and management of diabetes. Diabet Med 2018; 35: 541-547.

[22] Ismail K, Winkley K, de Zoysa N, Patel A, Heslin M, Graves H, Thomas S, Stringer D, Stahl D and Amiel SA. Nurse-led psychological intervention for type 2 diabetes: a cluster randomised controlled trial (Diabetes-6 study) in primary care. Br J Gen Pract 2018; 68: e531-e540.

[23] Ley SH, Chavarro JE, Li M, Bao W, Hinkle SN, Wander PL, Rich-Edwards J, Olsen S, Vaag A, Damm P, Grunnet LG, Mills JL, Hu FB and Zhang C. Lactation duration and long-term risk for incident type 2 diabetes in women with a history of gestational diabetes mellitus. Diabetes Care 2020; 43: 793-798.

[24] du Pon E, Wildeboer AT, van Dooren AA, Bilo HJG, Kleefstra N and van Dulmen S. Active participation of patients with type 2 diabetes in consultations with their primary care practice nurses - what helps and what hinders: a qualitative study. BMC Health Serv Res 2019; 19: 814.

[25] Hirahatake KM, Jiang L, Wong ND, Shikany JM, Eaton CB, Allison MA, Martin L, Garcia L, Zaslavsky O and Odegaard AO. Diet quality and cardiovascular disease risk in postmenopausal women with type 2 diabetes mellitus: the women's health initiative. J Am Heart Assoc 2019; 8: e013249.

[26] Mason SA, Rasmussen B, van Loon LJC, Salmon J and Wadley GD. Ascorbic acid supplementation improves postprandial glycaemic control and blood pressure in individuals with type 2 diabetes: findings of a randomized cross-over trial. Diabetes Obes Metab 2019; 21: 674-682.

[27] Cheng LJ, Jiang Y, Wu VX and Wang W. A systematic review and meta-analysis: vinegar consumption on glycaemic control in adults with type 2 diabetes mellitus. J Adv Nurs 2020; 76: 459-474.

[28] Ma XR. Effect of doctor-nurse-patient integration model in self-management education on self-efficacy and knowledge of the health of elderly patients with type 2 diabetes mellitus. Anhui Med Pharm J 2019; 23: 1651-1653.

[29] Cárdenas-Valladolid J, López-de Andrés A, Jiménez-García R, de Dios-Duarte MJ, Gómez-Campelo P, de Burgos-Lunar C, San Andrés-Rebollo FJ, Abánades-Herranz JC and Salinero-Fort MA. Effectiveness of standardized nursing care plans to achieve A1C, blood pressure, and LDL-C goals among people with poorly controlled type 2 diabetes mellitus at baseline: four-year follow-up study. BMC Fam Pract 2018; 19: 125.