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Impact of Health Education Based on IMCHB Model on School-age Children with Type 1 Diabetes

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Abstract: *The purpose of this project is to explore the impact of health education based on IMCHB model on the self-management ability of school-age children with type 1 diabetes. For this reason, we selected 90 school-age children with type 1 diabetes who were hospitalized in a tertiary A hospital in Dezhou City from January 2023 to August 2023 as the research objects, and randomly divided them into a control group and a test group. The control group received routine health education, including dietary guidance, medication guidance, disease observation, and expanded hospitalization guidance. The experimental group received IMCHB health education intervention on the basis of the control group, with a duration of 3 months. Compare the fasting blood glucose, 2-hour postprandial blood glucose levels, glycated hemoglobin values, and self-management behavior scale (SDSCA) scores between the two groups before and after intervention. The experimental results showed that after intervention, the fasting blood glucose and 2-hour postprandial blood glucose values in the experimental group were lower than those in the control group ($P<0.05$), and the difference was statistically significant; The glycated hemoglobin in the experimental group was lower than that in the control group ($P<0.05$); The SDSCA score of the experimental group was significantly higher than that of the control group, and the difference was statistically significant ($P<0.05$). Thus, it is concluded that the nursing intervention of health behavior interaction mode can effectively control the fasting blood glucose and 2-hour postprandial blood glucose of school-age children with type 1 diabetes, improve their self-management ability in the treatment process, and reduce and delay the occurrence of diabetes complications.*

Keywords: *IMCHB model, school-age, type 1 diabetes, self-management*

1. Introduction

Diabetes is a major basic disease endangering children's health. Worldwide, about 80% -90% of children's diabetes is Type 1 diabetes (T1DM) [1]. T1DM is a chronic systemic disease caused by insulin deficiency or insufficient action. Clinically, it is characterized by polyuria, polydipsia, overeating, and emaciation. There are reports that patients aged 0-10 with T1DM have a risk ratio of 4.11 for mortality, 7.38 for cardiovascular mortality, and 3.96 for non cardiovascular mortality; Women who suffer from illness before the age of 10 have a reduced life expectancy of 17.7 years, while men have a reduced life expectancy of 14.2 years. The latest data in Beijing shows that the incidence rate of T1DM among children aged 0-14 years is close to 4.21/100 thousand person years[2]. Among all age groups from children to adults, 10-14 years old is the age of high incidence. Research suggests that the incidence rate of T1DM in China is underestimated [3]. Due to the early onset of childhood T1DM, inability to live a regular life, poor self-control ability, and difficulty in controlling blood sugar levels, the long-term survival of children with T1DM is greatly threatened. Therefore, strengthening the management of childhood T1DM is very important.

2. Materials and Methods

2.1 Clinical data

Select 90 school-age children with type 1 diabetes who were admitted to a tertiary A hospital in Dezhou City from January 2023 to August 2023 as the research objects, and randomly divide them into a control group and a test group, with 45 people in each group. There are 20 males and 25 females in

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the control group, with an average age of (7.12 ± 1.10) years. There were 23 males and 22 females in the experimental group, with an average age of (8.23 ± 2.29) years. After statistical processing, the difference was not statistically significant (P>0.05).

2.2 Inclusion criteria

(1) Conforming to the Diagnostic Standards for Standardized Diagnosis and Treatment of Type 1 diabetes in Children in China [4]; (2) Age 6-12 years old, complete medical record information; (3) The patient and their family members agree to participate in the study; (4) The project has been approved by the ethics committee, and the patient or their family member has signed an informed consent form.

2.3 Exclusion criteria

(1) Other types of diabetes; (2) Concomitant complications such as heart, kidney, brain, and nerves[5].

2.4 Research Methods

Establish a research team consisting of 5 nursing staff, 1 nutritionist, and 1 deputy chief endocrinologist in pediatrics. The deputy chief physician of pediatric endocrinology is responsible for the training of children's diabetes professional knowledge; One deputy chief nurse of pediatrics, responsible for developing nursing intervention measures for healthy behavior interaction patterns; One head nurse, responsible for the homogenization training and assessment of research group members; Two pediatric chief nurses are responsible for collecting general information on the affected children, distributing survey questionnaires, and supervising the completion of research content. The researcher is responsible for data collection, analysis, and organization; One nutritionist is responsible for developing nutrition and exercise plans. Provide theoretical knowledge training on healthy behavior interaction patterns for members of the research group, with a training period of one month. After passing the assessment, they will be on duty [6].

Basic nursing: The nurse assesses the child within 2 hours of admission, collects general information about the child, including the child's age, gender, past history, family status, educational level of the child's parents, carries out health education on children's diabetes knowledge, detects peripheral blood glucose, draws venous blood to detect glycosylated hemoglobin, and establishes blood glucose monitoring record forms [7].

Control group: Routine health education was provided to the children and their parents, including dietary guidance, medication guidance, disease observation, and hospital extension guidance.

Experimental group: On the basis of the control group, the nursing staff of the research group implemented IMCHB nursing intervention on the children and their parents [8]. Two chief nurses from the scientific research team assessed the children within 2 hours after admission, collected general information about the children, including their age, gender, past history, family status, and educational level of their parents, carried out health education on children's diabetes knowledge, detected peripheral blood glucose, extracted venous blood to detect glycosylated hemoglobin, and established blood glucose monitoring record forms. According to children's demographic characteristics, emotional and psychological conditions, the Chinese version of diabetes self-management behavior scale was used to assess children's self-management ability from four aspects of diet, exercise, foot care and blood glucose monitoring, and to develop a child care intervention plan based on IMCHB [9]. (3) The members of the nurse patient interaction research team held a doctor patient meeting for the children and their families during hospitalization, issued diabetes health education manuals for the children and their families, let the children and their families take the initiative to speak, and understand the psychological state of the children and their families and their awareness of the disease. Draw pictures of daily diet, with calorie cards labeled on each picture to facilitate parents in calculating their daily calorie intake; Make short videos about health knowledge, diet and daily exercise methods of diabetes for parents and children to learn together. The meeting will last for 40 minutes, and a prize based Q&A session will be held to encourage children and their families to raise their hands to answer. Those who answer correctly will receive exquisite gifts, which maximizes their participation and improves treatment compliance [10]. (4) Decision control guidance helps children discover bad habits in their daily lives, helps them correct these bad habits, and improves their decision-making and control

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abilities. Dietary Decision: The diet should be diverse, with grains as the main ingredient. There should be grains, potatoes, vegetables, and fruits every day. Regular consumption of soy products, moderate consumption of nuts, moderate consumption of fish, shrimp, and eggs, and minimal consumption of fatty, fried, smoked, and pickled foods. Overeating should be avoided. Sports decision-making: fast walking, jogging, cycling, playing table tennis, play badminton, and doing exercises. Start exercising one hour after dinner, and exercise for 30-60 minutes every day, at least five days a week. Emergency decision-making: Mild hypoglycemia can be improved by self eating, with blood sugar levels greater than or equal to 3.0mmol/l and less than 3.9mmol/l. Self sweating, hand tremors, and palpitations may occur. Generally, 15-20 grams of sugary foods, such as cookies, candies, carbonated drinks, etc., are needed. Blood sugar levels should be retested for 30 minutes and still less than 3.9mmol/l. Glucose water or intravenous injection of glucose should be given. By dealing with emergency situations of hypoglycemia, continuously improving the emergency decision-making ability of patients and their families [11]. (5) At discharge, the research team members demonstrated and guided on-site blood glucose monitoring, insulin injection methods, precautions, and locations. Teach children and parents about blood sugar testing methods and insulin injection methods. (6) After being discharged from the hospital, the family members of the patient will be included in the "Little Sugar Treasure Communication Group". In the group, the patient and parents can communicate with medical staff about their blood sugar situation, diet, and self-management diary of insulin injection. Weekly photos will be taken and uploaded to the "Little Sugar Treasure Communication Group". The nurse will record the results in their personal file and regularly analyze the reasons for non-compliance, make timely adjustments and feedback, send a health education video or video email about diabetes to members of WeChat group every two weeks [12]. The scientific research team members send the two-dimensional code of the Chinese version of the diabetes children's self-management behavior scale in the group every month, asking parents to help the children scan the code and fill it in. It takes five minutes to evaluate the children's self-management ability [13].

2.5 Observation indicators

2.5.1 Blood glucose control situation

Measure the fasting blood glucose levels (FBG), 2-hour postprandial blood glucose levels (2h-PBG), and glycated hemoglobin (HbA1c) levels of the two groups of children before and at the third month of intervention. FBG and 2-hPBG were measured using glucose oxidase method, while HbA1c was measured using latex enhanced immunoassay.

2.5.2 Self management ability

The self-management ability of children before and after intervention was assessed with diabetes self-management behavior scale (SDSCA) [14]. Cronbach's is 0.84, including four dimensions of regular diet, exercise, blood glucose monitoring, and foot care, with 11 items. Score>23 points, good compliance, score 17-23 points, average compliance, score<17 points, poor compliance. The score is directly proportional to self-management ability. The higher the score, the higher the self-management ability of children with diabetes.

2.6 Statistical methods

SPSS 26.0 statistical software was used for data processing. Quantitative data were expressed as mean ± standard deviation, while count data were expressed as percentages (%). Independent sample t-tests and X^2 tests were used between groups, with $P<0.05$ indicating statistically significant differences.

3. Results

3.1 Comparison of therapeutic effects between two groups

Before intervention, there was no statistically significant difference in FBG, 2h-PBG, and HbA1c between the experimental group and the control group ($P>0.05$). After intervention, FBG, 2h-PBG, and HbA1c in the experimental group were significantly lower than those in the control group ($P<0.05$), as shown in Table 1.

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Table 1: Comparison of blood glucose and glycated hemoglobin between two groups of children before and after intervention

	Fasting blood glucose (mmol/L)		2-hour postprandial blood glucose(mmol/L)		HbA1c(%)	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Control group	9.3±1.4	6.8±0.9	12.7±2.3	9.6±0.5	8.4±1.5	7.6±0.6
Experimental group	9.4±1.7	5.3±0.6	12.6±2.1	8.4±0.7	8.7±1.3	6.4±0.4
T	0.308	7.069	0.329	4.369	0.092	7.582
P	0.714	0.000	0.742	0.002	0.826	0.000

3.2 Comparison of self-management abilities between two groups before and after intervention

There was no statistically significant difference in various indicators of self-management ability between the two groups before intervention (P>0.05). After intervention, the patients in the experimental group were significantly higher than those in the control group (P<0.05), and the difference was statistically significant. See Table 2 for details

Table 2: Comparison of self-management ability between two groups of children before and after intervention

	Diet		Motion		Foot Care		Blood Glucose Monitoring	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Control group	9.4±2.3	9.7±3.5	2.7±0.8	3.0±1.1	1.9±0.4	2.4±0.3	2.1±0.6	2.6±0.7
Experimental group	9.5±2.1	12.6±4.2	2.8±0.9	4.7±1.2	2.0±0.6	4.5±0.5	2.2±0.8	4.9±0.9
T	0.263	5.916	0.335	-3.157	0.239	-4.627	0.485	5.345
P	0.829	0.001	0.684	0.008	0.845	0.005	0.628	0.000

4. Discussion

Type 1 diabetes is a chronic life-long metabolic disorder complex disease. The most common population is 10-14 years old children, and the pathogenesis is pancreatic islets β Cell damage or decreased pancreatic secretion function, resulting in reduced insulin secretion, clinically characterized by high blood sugar and hypertension. As the disease progresses, ketoacidosis and neuropathy may also occur, seriously affecting the growth and development of the child, and causing heavy economic and psychological burden to the family and society. At present, the etiology of type 1 diabetes is not clear, which may be caused by the combined effect of genetic susceptibility and environmental factors[15]. The possible causes are as follows: (1) Autoimmune system defects. A variety of autoantibodies can be found in the blood of type 1 diabetes patients, such as glutamic acid decarboxylase antibody (GAD antibody), islet cell antibody (ICA antibody), etc. These abnormal autoantibodies can damage the B cells that secrete insulin in the human pancreas, making them unable to secrete insulin normally. (2) Genetic factors. At present, studies suggest that genetic defects are the basis of the pathogenesis of type 1 diabetes, and this genetic defect is manifested in the HLA antigen of human chromosome 6 and other gene loci. Research suggests that type 1 diabetes has the characteristics of familial onset - if your parents have diabetes, you are more likely to suffer from this disease than people without this family history[16]. (3) Virus infection may be a trigger. Many scientists suspect that viruses can also cause type 1 diabetes. This is because patients with type 1 diabetes often have a history of virus infection for a period of time before onset, and type 1 diabetes often occurs after the prevalence of virus infection. For example, the viruses that cause mumps and rubella, as well as the coxsackie virus family that can cause poliomyelitis, can play a role in type 1 diabetes. Due to the fact that the patient population is mainly in childhood or adolescence, and due to factors such as age and mental state, the compliance of patients is generally poor. How to improve the self-management ability of patients, effectively control blood sugar levels, and reduce glycated hemoglobin ratio has become a hot topic of clinical attention [17].

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The Interaction Model of Client Health Behavior (IMCHB) is a nursing practice model in which healthcare professionals evaluate the uniqueness of patients, establish interactive relationships with them, and plan, implement, and evaluate nursing outcomes. Based on the Health Belief Model (HBM), Suchman Model, Andersen and New man Model, and Self regulation Model, proposed by American nursing expert COX in 1982, this model is mainly composed of three elements: patient uniqueness, patient professional interaction, and patient health outcomes [18]. It emphasizes a patient-centered holistic nursing model, describes the uniqueness of patients, and provides a personalized approach to holistic nursing to record results. It is a model that can explain and predict health-related behaviors, reveal and calculate the effects of nursing interventions [19]. The IMCHB nursing model has been widely applied in nursing research abroad, such as exploring social influences and influencing factors on women's understanding of uterine biopsy and cervical cancer; it is necessary to study the determinants of nursing compliance of AIDS patients; Describe the background and dynamic variables (dietary habits and body mass index) that affect the mental health outcomes of school-age children, as well as other factors that influence the uniqueness of service recipients and health outcomes [20]. Domestic scholars have applied this model to health management of chronic diseases such as hypertension, rheumatoid arthritis, self-care ability of elderly diabetes foot patients [21]. At present, the application of IMCHB model and diabetes health management at home and abroad are mostly applied to the elderly, adults and young patients with perfect self-management ability and cognitive ability. There is not much research on school-age children whose self-management and cognitive abilities are not yet perfect and require close cooperation from parents to achieve [22]. In view of the uniqueness of school-age children with type 1 diabetes, IMCHB health management services are provided for school-age children with type 1 diabetes to achieve healthy outcomes, with daily life style management as the entry point [23].

This study adopts an interactive model based on health behavior for health education. After the patient is admitted, nursing staff first collect information from the patient to understand their family background and lifestyle habits, fully understand their uniqueness, and then provide targeted interactive care based on their uniqueness [24]. Due to the young age of the patient, nursing staff can mobilize their participation in various ways to improve their treatment compliance, Before discharge, the patient should undergo a self-management ability assessment to understand the improvement of self-management ability during hospitalization. At the same time, the patient should be guided to follow medical advice for dietary control after discharge, and regularly contact nursing staff to promptly answer any confusion encountered after discharge and help the patient adjust their bad behavior in a timely manner. IMCHB mode is a new type of health education mode. Through psychological support, knowledge popularization and other modes of intervention, it transmits effective information in the form of interaction, eliminates children's panic and irritability about diseases, changes children's understanding of diabetes, and is conducive to good control of blood sugar. In this study, the fasting blood glucose, 2-hour postprandial blood glucose, and glycated hemoglobin levels of the intervention group were significantly lower than those of the control group, while their self-management ability was significantly higher than that of the control group.

5. Conclusion

In summary, health education based on health behavior interaction mode can effectively control the blood sugar level of children with type 1 diabetes, improve their self-management ability, and help children improve their prognosis, which is worth recommending.

Author contributions

All authors have designed the study, developed the methodology, performed the analysis, and written the manuscript. All authors have read and agreed to the published version of the manuscript.

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