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Comprehensive nursing's effects on diabetic children's quality of life, nod-like receptor protein 3 levels, and inflammatory cytokines

Abstract

Our goal was to find out how comprehensive nursing care affected the children with diabetes's quality of life and inflammatory cytokine levels. Fifty-eight children with diabetes who were hospitalized to our hospital participated in a control study. The patients were randomly divided into two groups, one to serve as an observation group and the other as a control group. Each group had 29 cases. The control group consisted of children who were given the standard nursing care. The children in the control group received psychosocial, medical, nutritional, physical activity, disease-specific, daily living, and humanistic nursing care. Following nursing care, there was a significant difference ($P<0.05$) in the blood glucose indicators, self-rating anxiety and depression scale scores, and drug-administration compliance, quality of life, and nursing satisfaction scores between the observation group and the control group. Furthermore, we noticed that following nursing, the observation group's levels of Interleukin-8 (IL-8) and Nod-Like Receptor Protein 3 (NLRP3) were significantly lower ($P<0.05$). It is advisable to prescribe and implement comprehensive nursing care for children with diabetes, as it can successfully increase blood glucose levels, alleviate negative psychological effects, and enhance nursing satisfaction.

Keywords: Inflammatory cytokines; Comprehensive nursing; Pediatric diabetes; Quality of life.

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Introduction

One of the most prevalent clinical metabolic disorders, diabetes mellitus has a high incidence and is more prevalent in middle-aged and older adults [1]. Nonetheless, research indicates that diabetes is more common in younger people and that the number of pediatric cases of the disease is rising annually [2,3]. According to reports, the annual incidence of diabetes in children is rising by 3% and the growth rate of the disease is estimated to be 200 cases/d in China [4,5]. Children with diabetes who experience prolonged hyperglycemia may have a reduction in their body's resistance, which could have an impact on their physical and mental development [6]. If pediatric diabetes is not treated in a timely manner, it may worsen the child's condition over time, result in acidosis, dehydration, and other issues, and perhaps endanger the child's life [7]. Drug control is still utilized in clinical treatment for these diseases [8]. Insulin and hypoglycemia medications must be used rationally during the course of treatment [9]. But because diabetes is a chronic condition, nursing advice and explanation are required during the nursing time when the kid is receiving medication therapy. This will help to increase the child's compliance with treatment and guarantee the child's treatment plan develops smoothly [10]. The traditional nursing model can no longer suit the needs of clinical nursing because of its singular content. The nursing model must be continuously improved in order to guarantee the demands of the nursing staff [11]. Comprehensive nursing is a holistic approach to nursing care, offer-

ing focused and all-encompassing nursing services to children with illnesses from a variety of perspectives, such as psychology, health education, sickness, nutrition and exercise, day-to-day living, and humanistic care [12].

One of the primary causes of diabetes is low-level chronic inflammation [13,14]. Evidence from several research in both humans and animals suggest that inflammatory cytokines such TNF-α, IL-8, and IL-6 are more prevalent in diabetes patients. [15]. As a result, there is a strong correlation between inflammation and the onset of diabetes and insulin resistance. The inflammasome that has been studied the most to date is Nod-Like Receptor Protein 3 (NLRP3) [16]. The purpose of this study was to look into how comprehensive nursing care affected the quality of life, NLRP3 and inflammatory cytokine levels, in children with diabetes.

Materials and methods

General data

For the purpose of this randomized controlled trial, we recruited 58 pediatric patients with diabetes who were hospitalized to our hospital from 2018 to 2021. Using a random number system, two groups of patients were formed: one to act as a control and another to watch. The control group included 16 males and 13 females, with an average age of 14.56±1.57 kg/m² and a variety of diabetes durations (varying from 1-4 years, with an average of 2.32±0.23 years). Individuals taking part in the study were between the ages of three and twelve. Fifteen men and fourteen women made up the thirty-person observation group. Diabetes duration varied from one to four years, with an average of 2.26±0.21 years, and the average age was 14.62±1.68 kg/m². Children as young as three years old and as elderly as twelve years old took part. Using similar general statistics, we found no significant difference between the two groups (P>0.05).

In order to be included in the study, all of the following were needed: full and accurate clinical data, informed consent from sick children's families, approval from the ethics committee at Children Hospital Multan, and a diagnosis of diabetes, absence of mental illness, and positive results for both glucose and ketones in the urine.

Participant had any of the following conditions, they were not included in the study: other severe organ diseases, mental illness, a history of related diseases, cognitive and communication impairments of varying degrees, illiterate parents with impairments in cognition, communication, awareness, and mobility, blood and immune system disorders, long-term drug users, incomplete clinical data, or were dropped from the study.

Methods

Children in the control group who were sick got the usual nursing care, the primary aims of which were to provide a clean, quiet, well-organized treatment environment and to closely observe any changes in vital signs such as blood sugar levels. The sick children also received hypoglycemic medication as directed by their physician, and their disease observation was reinforced while they were receiving treatment. Following their admission to the hospital, the sick children and their families received basic life counseling and education about the significance of a healthy diet, regular exercise, insulin injections, blood glucose monitoring, and doctor-prescribed medicine.

The observation group provided comprehensive nursing care, with the following primary contents:

All-encompassing psychological nursing

All parties involved—the affected children, their families, and the medical staff—saw an improvement in the children's trust and willingness to cooperate, as well as an improvement in the family's ability to communicate and spend time together. Children with awareness issues who got verbal and physical affirmation and support were better able to comply, were more cared for, had their emotions stabilized, and were generally more comfortable as a result. It was also important to keep the sick children's families informed of any developments in their loved ones' illnesses so that they could better cope emotionally and psychologically with the news. The unwell youngsters could also get adequate sleep thanks to the well-thought-out visitation program. The importance of controlling blood glucose levels in relation to disease was emphasized, and it was brought to the attention of sick children's families.

Education on holistic health: Regular lectures with a diabetes theme were organized, and family members of the sick children received information about pediatric diabetes from senior and experienced physicians. The case introductions were colorful and complemented the straightforward language to convey a range of diabetic knowledge. Simultaneously, a diabetic health guidebook was released to raise the level of awareness of diabetes among the family members of affected children and to foster a healthy and hopeful outlook. The family members of the sick youngsters had their queries answered and misconceptions cleared up with patience.

All-inclusive care for the medical problem: Youngsters with pediatric diabetes were more likely to experience problems, thus it was important to improve real-time monitoring in order to recognize changes in the physical signs of the disease. The youngsters with the disease had their blood glucose levels regularly checked in order to prevent problems arising from variations in blood glucose levels and exacerbation of the illness. The sick children's daily dietary guidelines were tightened, adequate food was kept on hand as a supplement each day, and sweets like cakes, candy, etc. were outright forbidden. Sick youngsters with palpitations, pale skin, and dizziness were instructed to be fed soup or sweets during insulin therapy in order to prevent collapse. In order to receive therapy and an intravenous glucose infusion, the sick children with insulin shock needed to be reported to the physician in a timely manner and may exhibit symptoms like coma, incontinence, etc.

Advice on fitness and nutrition: Prior to insulin injection, the daily diet was supposed to be adjusted based on the sick children's preferences and severity of their condition. It was based on a high-protein, high-fiber diet that emphasized lightness, encouraged more fruit and vegetable consumption, and explicitly forbidden foods that cause irritation. It was recommended that unwell children engage in appropriate cardiovascular movements such as walking or running, and that their loved ones do the same, in the hopes that this would help stabilize their blood sugar levels.

All-encompassing care for everyday living: The families of the sick children were given information about the type and dosage of medication therapy, as well as its purpose and the significance of following doctor's prescriptions. The family members were also told to keep an eye on their child's blood sugar levels, and the amount of insulin was changed in real time to

prevent hypoglycemia. Children with illnesses needed to have their lips cleaned daily to prevent oral infections since sick children's mouths were more likely to harbor bacteria.

Humanistic medical attention: An inviting and peaceful ward atmosphere was established, and the inside space was maintained tidy, peaceful, clean, and hygienic. In order to help the sick children feel the compassion and concern of the medical staff, nurses must respect the sick children, show them kindness by greeting and smiling on a daily basis, tell them stories, play games with them, and build a stronger bond with their patients. This will help the sick children feel less alone and fearful in the hospital, which will lessen their need to cry and increase their cooperation.

Observation indicators

Medication compliance: To gauge the degree to which ill children adhered to their drug regimens, the department developed a questionnaire. The dependability of the 68-item scale was 0.896, and all of the scales were successfully retrieved. Noncompliance, partial compliance, and full compliance were the three groups used for evaluation.

Quality of life: The well-being of the ill children was evaluated comprehensively through the use of the QOL scale. The assessment covered a wide range of subjects, including physiological function, physical condition, mental health, and social function. One hundred points is assigned to each item. Better grades mean a better quality of life for the ill kids.

Indicators of blood glucose: Before and after nursing, the automated biochemical device measured the fasting venous blood of the unwell children and found their blood glucose indicators, which include glycosylated hemoglobin (HbAlc), 2-hour postprandial blood glucose (2hPG), and Fasting Plasma Glucose (FPG). The indicator values were compared between groups both before and after breastfeeding.

Variations in the serum concentrations of the marker NLRP3 and inflammatory cytokines: Venous blood was drawn from the sick youngsters both before and after they were nursed. The blood levels of the inflammatory cytokine IL-8 and the protein NLRP3 were evaluated using an enzyme-linked immunosorbent assay. Between groups, the indicator values were examined before and after nursing.

Mental condition: The influence of the nursing program on the psychological condition of the sick children was assessed by documenting changes in the Self-rating Depression Scale (SDS) [16] and Anxiety Scale (SAS) [15]. Anxiety and depression were positively correlated with the scale's evaluation scores. There were forty questions in all, and each question received a rough score between one and four. Standard score equals rough score *1.25. Anxiety/depression scores range from <50, which suggests normal anxiety/depression, to 50-60, which shows mild anxiety/depression, 61-70, which indicates moderate anxiety/depression, and >70, which indicates severe anxiety/depression.

Family members' pleasure with nursing: Utilizing department-prepared questionnaires, nursing satisfaction was analyzed and evaluated. Blood glucose control, operational abilities, communication skills, and nursing service attitude were all included in the evaluation's content. The one item received a score of 100. The family's satisfaction with the nursing measures increases with higher scores.

Analytical statistics

A program called SPSS 20.0 was used to examine the data. The data from the measurements were expressed as mean ± standard deviation, or X±S. For this purpose, we compared the categories using the t test. The X-test was used to evaluate the data count. A statistically significant difference was shown by proving a P-value less than 0.05.

Results

Comparison of blood glucose indicators between the two groups

The two groups exhibited no significant differences in blood glucose indicators (FPG, 2hPG, and HbA1c) prior to nursing (P>0.05). Post-nursing, a statistically significant difference was seen (P<0.05, Figure 1), with the observation group exhibiting lower levels of the specified markers in comparison to the control group. The technique implemented by the observation group has proven beneficial in managing diabetes in youngsters.

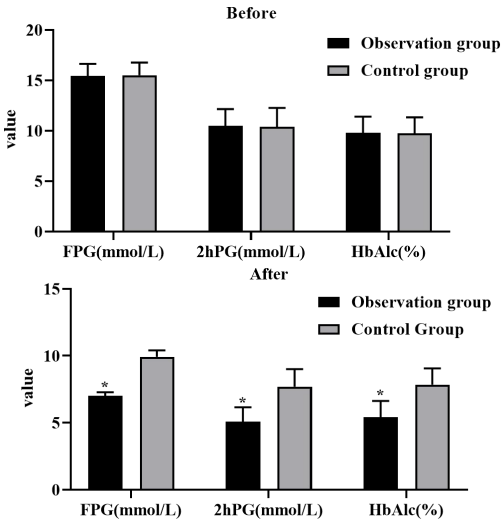

Figure 1: Both groups' pre- and post-nursing blood glucose indicators. **Note:** *P<0.05, compared with the control group.

Comparison of the psychological state between the two groups

Before nursing intervention, there was no notable change in psychological state between the two groups as assessed by SDS and SAS scores (P>0.05). Post-nursing, a statistically significant difference was seen between the observation group and the control group, with the observation group exhibiting lower SAS and SDS scores (P<0.05, Figure 2). The observation group's technique appears to enhance the well-being of diabetic kids.

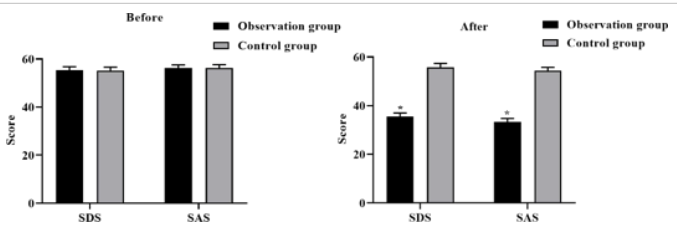

Figure 2: Mental health statuses of the two groups before and during nursing care. **Note:** *P<0.05, compared with the control group.

Comparison of nursing satisfaction of family members between the two groups

When comparing the two groups, the observation group reported far higher levels of nursing satisfaction (P<0.01, Table 1).

Table 1: Nurses' ability to make their loved ones happy in the two categories.

Groups	Service attitude	Operational skills	Communication skills	Blood glucose control
Observation group (n=29)	84.88±8.07	89.85±5.86	86.56±7.07	94.81±5.36
Control group (n=29)	79.62±8.14	84.33±6.17	81.88±7.12	88.14±5.54
X^2				4.762
P				<0.01

Comparison of medication compliance between the two groups

There was a notable disparity in medication compliance between the control group (75.66%) and the observation group (96.55%) (P<0.01, Table 2).

Table 2: Adherence to drug regimens between the two sets.

Groups	N	Complete compliance	Partial compliance	Non-compliance	Compliance rate (%)
Observation group (n=29)	29	22	6	1	28(96.55)
Control group (n=29)	29	14	8	7	22(75.86)
x2					4.762
P					<0.01

Comparison of quality-of-life scores between the two groups

Comprehensive nursing has the ability to enhance the lives of children with diabetes, as evidenced by higher quality of life scores in the observation group when contrasted with the control group (P<0.05, Figure 3).

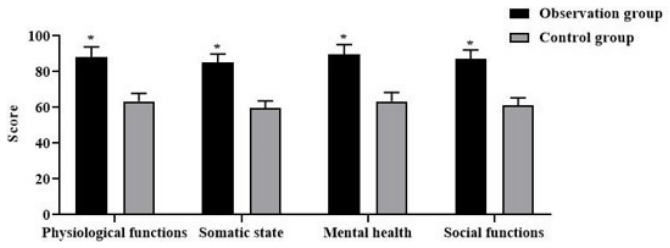

Figure 3: Life satisfaction ratings for the two categories. **Note:** *P<0.05, compared with the control group.

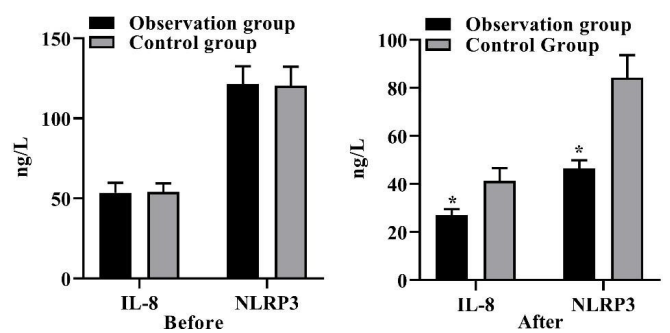

Figure 4: Levels of IL-8 and NLRP3 in the two groups both before and after nursing. **Note:** *P< 0.05, compared with the control group.

Comparison of IL-8 and NLRP3 levels between the two groups

Figure 4 demonstrates that both the observation group and the control group's IL-8 and NLRP3 levels differed significantly during breastfeeding compared to before nursing, when both groups' levels were similar (P>0.05).

According to these findings, children with diabetes who had full nursing care had less inflammation.

Discussion

Chronic diabetes is a long-term illness. People's food habits, lifestyle modifications, and family history will all affect their chance of contracting the disease [17]. With the traits of a protracted illness and a sluggish rate of progression, the general trend is rising. Ketoacidosis is the primary sign of the disease in its early stages. The health and development of the ill youngsters would be severely impacted if the disease's progression is not stopped in a timely and efficient manner [18,19]. Research and survey data have shown that children with diabetes have a chronically poor physical and psychological state that can lead to hypoglycemia coma. When long-term insulin treatment is combined with varying degrees of decreased sensitivity and insufficient insulin secretion, sick children have substantial postprandial blood glucose fluctuations, raising the risk of cardiovascular events. Nursing treatments should be implemented with caution because children with diabetes have low self-control and cognitive abilities [20].

Corresponding nursing interventions are required in clinical practice for children with diabetes in order to support the diseased child's recovery. The children's bodily function and self-consciousness are weak, and their age is comparatively young. Nursing and therapeutic therapy are therefore more challenging [21]. The routine nursing approach is neither systematic or planned for in practice, and it is not immediately apparent how this improves children's symptoms and signs [22]. The hospital's comprehensive nursing program for children with diabetes aimed to stabilize their blood glucose levels, improve the comfort of ill children, and ensure the quality of nursing services. The results showed that the observation group improved more on the blood glucose indicators (FPG, 2hPG, and HbAlc) than the control group, even if their SDS and SAS scores were lower. Furthermore, the observation group showed significantly higher rates of medication compliance among sick children compared to the control group. Furthermore, family members in the observation group reported higher levels of nurse satisfaction and quality of life compared to the control group. The study's findings showed that everyday life nursing helped lower blood glucose levels in diabetic youngsters. The following are the causes: Given the unique needs of young children, the management and treatment of diabetes involve a lengthy process for which the thoughtful, rational, and scientific nursing approaches chosen are crucial. The nursing needs of sick children cannot be met by conventional nursing because of its narrow focus and one model [23]. Comprehensive nursing is a type of contemporary nursing approach that emphasizes people-orientation and works to improve the physical and mental well-being of sick children by offering them high-quality, round-the-clock nursing care [24]. Among these is psychological comprehensive nursing, which provides support and advice to enhance family members' and sick children's trust in therapy as well as the psychological well-being of both groups [25]. To lower the likelihood of unfavorable outcomes, the comprehensive nursing of

daily life directs the daily medication, insulin monitoring, and oral infection prevention for sick children [26]. Comprehensive nursing care for an ill child involves treating the child's symptoms as soon as possible and guiding their daily nutrition to improve their prognosis for recovery [27]. The purpose of health education is to dispel myths and increase awareness among family members of sick children. In sick children, blood lipids and blood sugar levels can be stabilized with diet and activity instruction. Children with illnesses no longer fear the medical setting thanks to humanistic care, which also strengthens the bond between nurses and patients, gives sick children the self-assurance they need to conquer their conditions, and treats them with hope and optimism [28].

Trimeric complexes containing caspase-1 precursor, NLRP3, and apoptosis-associated speck-like protein are known as the NLRP3 inflammasome. Certain immune cells, such as macrophages and dendritic cells, can activate caspase-1 when the intracellular NLRP3 protein and IL-1β precursor are upregulated. According to the source, this process promotes the development of IL-1β and IL-18 precursor and causes inflammation, which can manifest as damage to specific tissues or a broad inflammatory response [29]. Experiments in rats with type 2 diabetes have shown that diabetic cardiomyopathy can be ameliorated by lowering NLRP3 gene expression [30]. Deactivating the NLRP3 inflammasome is one way epigallocatechin-3-gallate reduces inflammation and diabetes-induced glucose tolerance [31]. The NLRP3 inflammasome is blocked by gastrodinamina in mice, which reduces cognitive deterioration and depressive-like behaviors. These findings suggest a potential role for the NLRP3 inflammasome in the onset of diabetes. The results showed that the levels of IL-8 and NLRP3 were significantly lower in the observation group compared to the control group. This lends credence to the idea that comprehensive nursing care helps lower the body's inflammatory response in unwell children, which improves their prognosis and delays the course of their disease.

Conclusion

It is recommended and appropriate to use comprehensive nursing to raise blood glucose levels, alleviate negative psychological effects, and increase nursing satisfaction in children with diabetes. The study's sample size is limited, so it is impossible to completely rule out bias in the results when comparing the clinical data from the two groups. In order to validate our findings, we therefore intend to carry out a prospective study involving more patients and follow-up.

Author declarations

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