



Effects of Comprehensive Nursing on Quality of Life and Levels of Nod-Like Receptor Protein 3 and Inflammatory Cytokines in Diabetic Children

Suoqin Wu, Lanlan Zhu *, Ting Dong and Qin Zhou

Department of Pediatrics, Taizhou People's Hospital, Taizhou 225300, Jiangsu, China

*Corresponding Author: Lanlan Zhu, Department of Pediatrics, Taizhou People's Hospital, Taizhou 225300, Jiangsu, China E-mail: zhulanlan82@163.com

Received: 03 Dec, 2022, Manuscript no. aeb-22- 82204; **Editor assigned:** 06 Dec, 2022, Pre QC no. aeb-22- 82204 (PQ); **Reviewed:** 19 Dec, 2022, QC no. aeb-22- 82204 (Q); **Revised:** 22 Dec, 2022, Manuscript no. aeb-22- 82204 (R); **Published:** 20 Jan, 2023

ABSTRACT

We aimed to investigate the effect of comprehensive nursing on the quality of life and levels of inflammatory cytokines in diabetic children. A controlled study was carried out with 58 diabetic children admitted to our hospital. According to the random number table method, patients were divided into the control group and the observation group, with 29 cases in each. Children in the control group were given routine nursing measures. Children in the observation group were given comprehensive nursing including psychology, health education, illness, diet and exercise, daily life, and humanistic care. After nursing, compared with the control group, the blood glucose indicators, self-rating anxiety scale, and self-rating depression scale score significantly decreased ($P < 0.05$), while the drug-administration compliance, quality of life scores, and nursing satisfaction scores were significantly improved in the observation group ($P < 0.05$). Additionally, we observed that the levels of nod-like receptor protein 3 (NLRP3) and interleukin-8 (IL-8) in the observation group were significantly decreased after nursing ($P < 0.05$). Comprehensive nursing for diabetic children can effectively improve patients' blood glucose, relieve negative psychology, and improve nursing satisfaction, which is worthy of recommendation and application.

Keywords: Comprehensive Nursing; Inflammatory Cytokines; Pediatric Diabetes; Quality of Life; Diabetes

INTRODUCTION

Diabetes mellitus is one of the common clinical metabolic diseases, which is more common in middle-aged and elderly people, with a high incidence [1]. However, it has been revealed that the incidence of diabetes is younger, and the number of pediatric diabetes is increasing year by year [2,3]. It has been reported that the growth rate of diabetic children in China is approximately 200 cases per day, and the annual incidence is increasing by 3% [4]. Long-term hyperglycemia in diabetic children can lead to a decline in the body's resistance, affecting the physical and mental development of children [5]. If pediatric diabetes is not treated in time, it can lead to the continued aggravation of the children's condition, cause dehydration, acidosis, and other complications, and even threaten the children's life and safety [5]. For such diseases, drug control is still used in clinical treatment [6]. During the treatment period, it is necessary to strengthen the rational use of hypoglycemic drugs and insulin [6]. However, diabetes is a long-term disease, thus it is necessary to provide nursing guidance and explanation during the nursing period while taking drug therapy, to improve the children's compliance with treatment and ensure the smooth development of treatment for children [7]. Due to the single content of the conventional nursing model, it can no longer meet the needs of clinical nursing. To ensure the nursing needs, the nursing model needs to be continuously improved [8]. Comprehensive nursing is an all-around nursing service model, which provides comprehensive and targeted nursing services to diseased children from multiple aspects, including psychology, health education, illness, diet and exercise, daily life, and humanistic care [9].

Low-level chronic inflammation is one of the main causes of diabetes [10,11]. Numerous studies in humans and animals have shown that elevated levels of proinflammatory cytokines are found in diabetic patients, including TNF- α , IL-8, and IL-6 [12-14].

Therefore, inflammation is closely related to insulin resistance and the development of diabetes. Nod-like receptor protein 3 (NLRP3) is the most characterized inflammasome to date [11]. This study aimed to investigate the effect of comprehensive nursing on the quality of life and levels of NLRP3 and inflammatory cytokines in diabetic children.

MATERIALS AND METHODS

General data

The 58 diabetic children admitted to our hospital from January 2018 to December 2021 were enrolled as the research subjects to carry out a controlled study, and according to the random number table method, patients were divided into the control group and the observation group. There were 16 males and 13 females in the control group; the youngest was 3 years old, and the oldest was 12 years old, with an average of 7.2 years \pm 1.37 years; the course of diabetes was 1 years-4 years, with an average of 2.32 years \pm 0.23 years; the mean Body Mass Index (BMI) was 14.56 kg/m² \pm 1.57 kg/m². There were 15 males and 14 females in the observation group; the youngest was 3 years old, and the oldest was 12 years old, with an average of 7.29 years \pm 1.37 years; the course of diabetes was 1 years-4 years, with an average of 2.26 years \pm 0.21 years; the mean BMI was 14.62 kg/m² \pm 1.68 kg/m². There was no significant difference in general data between the two groups ($P > 0.05$), which was comparable.

Inclusion criteria: Those who were positive in the urine glucose test and positive in the urine ketone test; those who met the diagnostic criteria for diabetes; those who had no mental illness; those who were hospitalized for the first time; the clinical data were in a complete state, and the family members of the diseased children were aware of the research contents, and all voluntarily signed the informed consent; the ethics committee of the Taizhou People's Hospital reviewed and approved of the study.

Exclusion criteria: those with other types of serious organ diseases; those with mental illness and a history of related diseases; those with varying degrees of cognitive impairment and communication impairment; those whose parents were illiterate and had cognitive, communication, awareness, and mobility impairments; genetic diseases and congenital diseases; those with genetic diseases and congenital diseases; those with blood diseases and immune diseases; long-term drug abusers; those with incomplete clinical data; those dropped out of the research.

Methods

The diseased children in the control group were treated with routine nursing measures, the main content of which was to provide a comfortable, quiet, tidy, and clean treatment environment for the diseased children, and to closely monitor the changes in blood glucose and other related signs during treatment and nursing; the diseased children were given hypoglycemic treatment measures as prescribed by the doctor, and the disease observation was strengthened during the treatment process. After the diseased children were admitted to the hospital, basic life guidance was given, and the diseased children and their families were informed of the importance of diet, exercise, insulin injection, monitoring blood glucose, and medication as prescribed by the doctor.

The observation group carried out comprehensive nursing, the main contents were as follows:

- **Comprehensive psychological nursing:** The communication and interaction with the family members of the diseased children were strengthened, the trust and goodwill of the diseased children were elevated, and the treatment confidence of the diseased children's family members was improved. The diseased children with disorders of consciousness were encouraged and supported through words and touches, improving their compliance, giving them concern and care, stabilizing their emotions, and making them feel safe. At the same time, the family members of the diseased children were informed of the relevant knowledge of the disease and the treatment process and were also informed of the changes in the disease promptly, to stabilize the psychological state of the family members of the diseased children, and the visit time was reasonably arranged so that the diseased children could get adequate rest. The influence of blood glucose levels on the disease was emphasized and the awareness of the family members of the diseased children on blood glucose control was raised.
- **Holistic health education:** Diabetes-themed lectures were held regularly, and experienced and senior physicians disseminated knowledge about pediatric diabetes to the family members of the diseased children. The language was kept simple and easy to understand, and it was accompanied by vivid case introductions to reflect various knowledge of diabetes. At the same time, a handbook of diabetes health knowledge was issued to enhance the family members of the diseased children with awareness of diabetes and to establish a positive and optimistic attitude. The questions raised by the family members of the diseased children were patiently explained and their misconceptions were corrected.
- **Comprehensive nursing of the disease condition:** Children with pediatric diabetes had more risks of complications, and it was necessary to strengthen real-time monitoring to grasp the changes in children's physical indicators. The blood glucose level of the diseased children was closely monitored to avoid complications related to blood glucose fluctuations and aggravation of the disease. The guidance of the diseased children's daily diet was strengthened, appropriate food was kept as a supplement every day, and sweets such as cakes, candies, etc., were strictly prohibited. During insulin therapy, diseased children with dizziness, pale complexion, and palpitations were supposed to be given sweets or soup to avoid collapse. The diseased children with insulin shock may have symptoms such as coma, incontinence, etc., and need to be reported to the doctor in time for treatment and given intravenous glucose infusion.

- Diet guidance and exercise guidance: Before insulin injection, the daily diet was supposed to be guided according to the diseased children's dietary preferences and the degree of illness, with a high-protein and high-fiber diet as the mainstay, focusing on lightness, encouraging the consumption of more fruits and vegetables, and strictly prohibiting the consumption of irritating foods. At the same time, diseased children were guided to choose appropriate aerobic exercise, such as walking, jogging, etc., and diseased children's family members were encouraged to participate together, to effectively stabilize diseased children's blood glucose levels.
- Comprehensive nursing of daily life: The family members of the diseased children were informed of the method and dosage of drug therapy and explained the role of drug therapy, stressing the importance of taking medications as prescribed by the doctor, the family members of the diseased children were instructed to monitor blood glucose, and the insulin dosage was adjusted in real-time according to the blood glucose level to avoid hypoglycemia. Diseased children's mouths were prone to bacteria, so it was necessary to clean the diseased children's mouths every day to avoid oral infections.
- Humanistic care: A warm and harmonious ward environment was created, and the indoor environment was kept comfortable, quiet, clean, and hygienic. Nursing staff needed to respect the diseased children, take the initiative to greet and smile at the diseased children every day, take the initiative to tell stories to the diseased children, accompany the diseased children to play games, and bring the relationship between nurses and patients closer, so that the diseased children felt the concern and care of the medical staff and eliminated the diseased children's fear, unfamiliarity, and tension in the medical environment, reducing crying and improving their cooperation.

Observation indicators

- Medication compliance: A questionnaire prepared by the department was used to evaluate the medication compliance of diseased children. A total of 68 scales were distributed, the recovery rate was 100%, and the reliability of the scale was 0.896. It was divided into complete compliance, partial compliance, and non-compliance for evaluation.
- Quality of life: The QOL scale was used to comprehensively evaluate the quality of life of diseased children. The evaluation content included physiological function, somatic state, mental health, and social function. The scores of each item were 100 points. The higher the scores, the better the quality of life of the diseased children.
- Blood glucose indicators: Fasting venous blood was collected from the diseased children before and after nursing, and the blood glucose indicators of the diseased children were detected by the automatic biochemical instrument, including Fasting Plasma Glucose (FPG), 2-hour postprandial blood glucose (2hPG), and glycosylated hemoglobin (HbA1c). The indicator values before and after nursing were compared between groups.
- Changes in the levels of inflammatory cytokines and marker NLRP3 in serum: Fasting venous blood was collected from the diseased children before and after nursing. The serum levels of inflammatory cytokine IL-8 and protein NLRP3 were detected by enzyme-linked immunosorbent assay. The indicator values before and after nursing were compared between groups.
- Psychological state: By recording the changes in the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS), the evaluation of the impact of the nursing program on the psychological state of the diseased children was completed. There was a positive relationship between the evaluation scores of the scale and anxiety and depression [15,16]. A total of 40 questions were scored, with a total rough score of 1-4 for each question. The rough score, $1.25 = \text{standard score}$. A score < 50 represents normal anxiety/depression; a score of 50-60 represents mild anxiety/depression; a score of 61-70 indicates moderate anxiety/depression; a score > 70 indicates severe anxiety/depression.
- Nursing satisfaction of family members: The analysis and evaluation of nursing satisfaction were carried out using questionnaires prepared by the department. The evaluation content involved nursing service attitude, operational skills, communication skills, and blood glucose control. The single item was scored as 100 points. The higher the scores, the greater the family's satisfaction with the nursing measures.

Statistical analysis

SPSS 20.0 software was used to analyze the data. Measurement data were expressed by mean \pm standard deviation ($\pm S$). Comparison between groups was performed by t-test. Count data was assessed by the χ^2 test. $P < 0.05$ indicated that the difference was statistically significant.

RESULTS

Comparison of blood glucose indicators between the two groups

There was no significant difference in blood glucose indicators (FPG, 2hPG, and HbA1c) between the two groups before nursing ($P > 0.05$); after nursing, the above indicators in the observation group were lower than those in the control group, and the difference was statistically significant ($P < 0.05$, Figure 1). It demonstrated that the scheme for the observation group is conducive to the control of blood glucose in diabetic children.

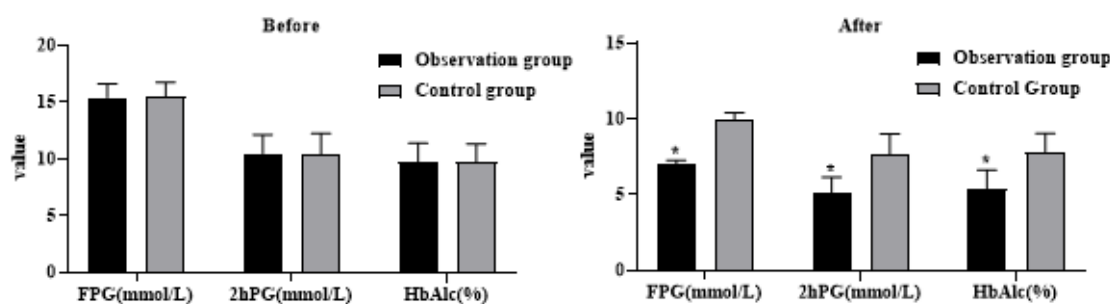


Figure 1. The blood glucose indicators in the two groups before and after nursing
 Note: *P< 0.05, compared with the control group.

Comparison of the psychological state between the two groups

Before nursing, there was no significant difference in the psychological state (SDS score and SAS score) between the two groups (P>0.05); after nursing, the SAS score and SDS score in the observation group were lower than those in the control group, and the difference was statistically significant (P<0.05, Figure 2). These data suggested that the scheme for the observation group could alleviate the negative emotions in diabetic children.

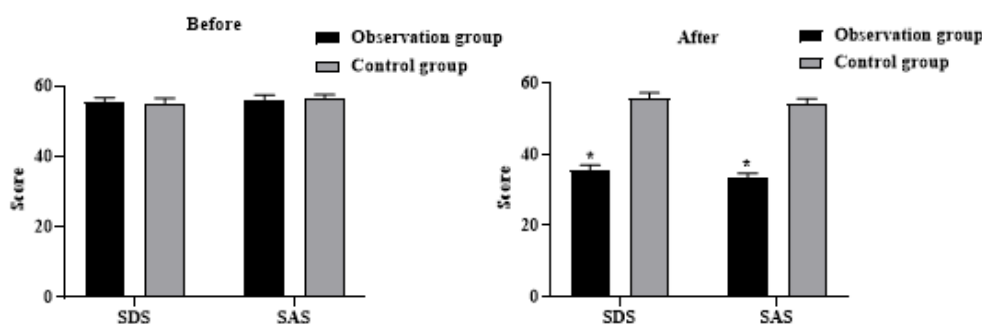


Figure 2. The psychological state in the two groups before and after nursing
 Note: *P< 0.05, compared with the control group

Comparison of nursing satisfaction of family members between the two groups

The nursing satisfaction in the observation group was greater than that in the control group, and the difference was statistically significant (P<0.01, Table 1).

Table 1. Nursing satisfaction of family members in the two groups

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 P				4.762< 0.01

Comparison of medication compliance between the two groups

The medication compliance in the control group was 75.86%, and the medication compliance in the observation group was 96.55%, and the difference was statistically significant (P<0.01, Table 2).

Table 2. Medication compliance in the two groups

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)
X ² P					4.762< 0.01

Comparison of quality of life scores between the two groups

The quality of life scores in the observation group were higher than those in the control group, and the difference was statistically significant ($P < 0.05$, Figure 3), which suggested that comprehensive nursing can improve the quality of life of diabetic children.

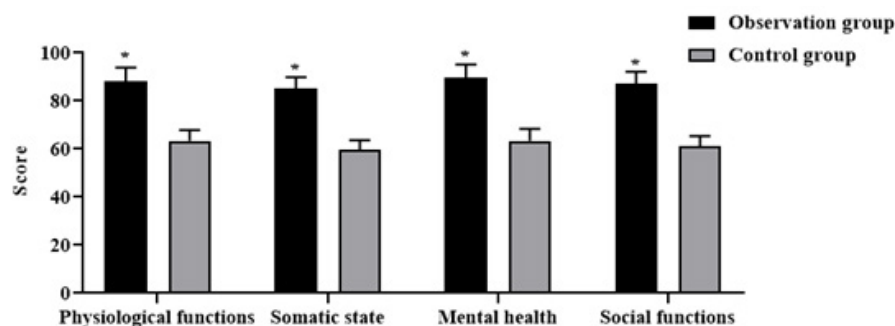


Figure 3. The quality of life scores in the two groups

Note: * $P < 0.05$, compared with the control group.

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

There was no significant difference in IL-8 and NLRP3 levels between the groups before nursing ($P > 0.05$); after nursing, the above indicators in the observation group were lower than those in the control group, and the difference was statistically significant ($P < 0.05$, Figure 4). These data indicated that comprehensive nursing could inhibit inflammation in diabetic children.

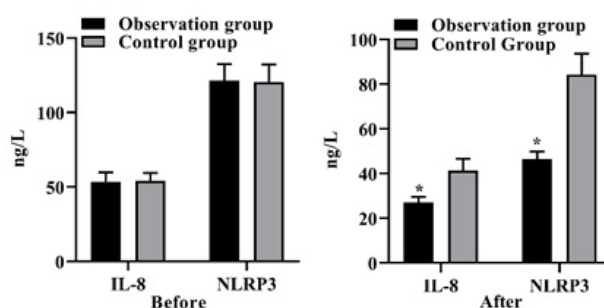


Figure 4. The IL-8 and NLRP3 levels in the two groups before and after nursing

Note: * $P < 0.05$, compared with the control group.

DISCUSSION

Diabetes is a long-term chronic disease. The probability of the disease will change with people's dietary habits, lifestyle changes, and family history [17]. The overall trend is on the rise, with the characteristics of long duration and slow disease progression [18, 19]. Pediatric diabetes generally occurs at the age of 5 years-6 years or 10 years-14 years. The cause of the disease is closely related to genetics, abnormal immune function, environment, and other factors. The early symptoms of the disease are mainly ketoacidosis. If the development of the disease is not controlled in a timely and effective manner, it will have a serious impact on the diseased children's health and growth as well as development [20,21]. Relevant survey and research data have confirmed that diabetic children have a long-term poor physical and psychological state, which will induce hypoglycemic coma. Coupled with long-term insulin application, there are different degrees of insufficient insulin secretion and reduced sensitivity, resulting in severe postprandial blood glucose fluctuations in diseased children, which increases the probability of cardiovascular events. Because of the poor self-control and cognitive ability of diabetic children, attention should be paid during the implementation of nursing interventions [22].

For diabetic children, corresponding nursing interventions are needed in clinical practice to promote the recovery of the diseased children's condition. The children's age is relatively young, and their somatic function and self-consciousness are weak. Thus, clinical treatment and nursing are more difficult [23]. In practice, the routine nursing model lacks systematicness and planning, and the improvement effect on children's symptoms and signs is not obvious [24,25]. To ensure the quality of nursing services, improve the comfort of diseased children, and stabilize the blood glucose level of diseased children, the hospital provided comprehensive nursing for diabetic children. The results demonstrated that the improvement of blood glucose indicators (FPG, 2hPG, and HbA1c) in the observation group were greater than those in the control group, and the SDS and SAS scores were lower than those in the control group. In addition, the medication compliance of diseased children in the observation group was much higher than that in the control group;

the quality of life scores of diseased children and nursing satisfaction scores of family members in the observation group were higher than those in the control group. The study confirmed that daily life nursing has a positive significance for improving blood glucose levels in diabetic children. The reasons are as follows: The control and treatment of diabetes is a relatively long process, especially based on the particularity of young children, and the selection of careful, reasonable, and scientific nursing measures is of great significance. Conventional nursing is broad in content and single in the model, which cannot meet the nursing needs of diseased children [26]. Comprehensive nursing is a kind of modern nursing model, which pays attention to people's orientation and promotes the physical and psychological improvement of diseased children by providing high-quality, continuous, and all-around nursing services to diseased children [27]. Among them, psychologically comprehensive nursing cares about the psychological state of diseased children and their family members and improves diseased children's compliance and family members' confidence in treatment through communication and guidance [28]. The comprehensive nursing of daily life guides diseased children's daily medication, insulin monitoring, and oral infection prevention to reduce the occurrence of adverse events [28,29]. Comprehensive nursing of the disease condition is to deal with the symptoms of the diseased children in time and guide the diseased children's daily diet to promote the prognostic recovery of the diseased child [30]. Health education is to popularize knowledge among diseased children's family members and correct their misconceptions. Diet and exercise guidelines can stabilize blood lipids and blood glucose in diseased children. Humanistic care eliminates diseased children's fear of the medical environment, brings closer the relationship between nurses and patients, helps diseased children build up the self-confidence to overcome the disease, receiving treatment with a positive and optimistic attitude [31,32].

The NLRP3 inflammasome is a multiprotein oligomer composed of NLRP3, apoptosis-associated speck-like protein, and caspase-1 precursor. In immune cells such as macrophages, dendritic cells, etc., caspase-1 can be activated by upregulating intracellular NLRP3 protein and IL-1 β precursor, which further induces the maturation of IL-1 β and IL-18 precursor and exerts pro-inflammatory functions, resulting in local tissue inflammatory damage or systemic inflammatory response [33]. Studies have indicated that NLRP3 gene silencing ameliorates diabetic cardiomyopathy in a type 2 diabetes rat model [34]. Epigallocatechin-3-gallate prevents inflammation and diabetes-induced glucose tolerance through the inhibition of NLRP3 inflammasome activation [35]. Gastrodin represses cognitive dysfunction and depressive-like behaviors by inhibiting NLRP3 inflammasome activation in mice [36]. These studies indicate that NLRP3 inflammasome is involved in the development of diabetes. The results of this study demonstrated that the levels of IL-8 and NLRP3 in the observation group were much lower than those in the control group, indicating that comprehensive nursing can improve the inflammatory response of diseased children to a certain extent, delay the disease progress, and promotes the prognostic recovery of patients.

CONCLUSION

Comprehensive nursing for diabetic children can effectively improve blood glucose, relieve negative psychology, and improve nursing satisfaction, which is worthy of recommendation and application. However, the limitation of this study is that the sample size of the study is small, and the comparison of the clinical data of the two groups cannot exclude the bias of the results. Thus, we hope to conduct a prospective study with more patients and follow up to solidify our conclusions.

REFERENCES

- Schmidt, A.M., Highlighting diabetes mellitus: the epidemic continues. *Arteriosclerosis, thrombosis, and vascular biology*, **2018**.38(1):p. e1-8.
- Mulvaney, S.A., et al., A retrospective multisite examination of depression screening practices, scores, and correlates in pediatric diabetes care. *Translational Behavioral Medicine*, **2021**.11(1):p. 122-131.
- Aalders, J., et al., The division and transfer of care responsibilities in paediatric type 1 diabetes: A qualitative study on parental perspectives. *Journal of advanced nursing*, **2021**.77(4):p. 1968-1979.
- Juan, J., and Yang, H., Prevalence, prevention, and lifestyle intervention of gestational diabetes mellitus in China. *International Journal of Environmental Research and Public Health*, **2020**.17(24):p. 9517.
- Akre, C., and Suris, J.C., From controlling to letting go: what are the psychosocial needs of parents of adolescents with a chronic illness?. *Health Education Research*, **2014**. 29(5):p. 764-772.
- Di, Iorgi, N., et al., Diabetes insipidus—diagnosis and management. *Hormone research in paediatrics*, **2012**.77(2):p. 69-84.
- American Diabetes Association. 12. Children and adolescents: standards of medical care in diabetes—2018. *Diabetes care*, **2018**. 41(Supplement_1):S126-36.
- Wang, J., Zhao, Y., and Xie, F., Study on the Nursing Effect of Diabetes Health Education Nursing Methods Applied to Diabetes Patients in the Endocrinology Department. *Journal of Healthcare Engineering*, 2022 :p. 2022.
- Wu, Y., Xu, M., and Zheng, G., Application of diversified and quantitative management model of exercise intervention in patients with gestational diabetes mellitus. *The Journal of Maternal-Fetal & Neonatal Medicine*, **2021**:p. 1-7.
- Muriach, M., et al., Diabetes and the brain: oxidative stress, inflammation, and autophagy. *Oxidative medicine and cellular longevity*, **2014**: p. 102158.
- Wang, C., et al., NLRP3 inflammasome activation triggers gasdermin D-independent inflammation. *Science immunology*, **2021**.

- 6(64):p. eabj3859.
12. Berbudi, A., et al., Type 2 diabetes and its impact on the immune system. *Current diabetes reviews*, **2020**.16(5):p. 442.
 13. Shoelson, S.E., Lee, J., and Goldfine, A.B., Inflammation and insulin resistance. *The Journal of clinical investigation*, **2006**.116(7):p. 1793-1801.
 14. Saltiel, A.R., and Olefsky, J.M., Inflammatory mechanisms linking obesity and metabolic disease. *The Journal of clinical investigation*, **2017**.127(1):p. 1-4.
 15. Lin, C.H., et al., Comparison of physician-rating and self-rating scales for patients with major depressive disorder. *Journal of clinical psychopharmacology*, **2014**.34(6):p. 716-721.
 16. Dunstan, D.A., and Scott, N., Norms for Zung's self-rating anxiety scale. *BMC psychiatry*, **2020**.20(1):p. 1-8.
 17. Ojo, O., Dietary intake and type 2 diabetes. *Nutrients*, **2019**.11(9):p. 2177.
 18. Thipsawat, S., Early detection of diabetic nephropathy in patient with type 2 diabetes mellitus: A review of the literature. *Diabetes and Vascular Disease Research*, **2021**. 18(6):p. 14791641211058856.
 19. Eid, S., et al., New insights into the mechanisms of diabetic complications: role of lipids and lipid metabolism. *Diabetologia*, **2019**. 62(9):p. 1539-1549.
 20. Streisand, R., and Monaghan, M., Young children with type 1 diabetes: challenges, research, and future directions. *Current diabetes reports*, **2014**.14(9):p. 1-9.
 21. Neu, A., et al., Diagnosis, therapy and follow-up of diabetes mellitus in children and adolescents. *Experimental and Clinical Endocrinology & Diabetes*, **2019**.127(S 01):p. S39-72.
 22. Berg, C.A., et al., Role of parental monitoring in understanding the benefits of parental acceptance on adolescent adherence and metabolic control of type 1 diabetes. *Diabetes Care*, **2008**. 31(4):p. 678-683.
 23. Beveridge, R.M., and Berg, C.A., Parent-adolescent collaboration: An interpersonal model for understanding optimal interactions. *Clinical Child and Family Psychology Review*, **2007**.10(1):p. 25-52.
 24. Beveridge, R.M., et al., Mother and adolescent representations of illness ownership and stressful events surrounding diabetes. *Journal of pediatric psychology*, **2006**. 31(8):p. 818-827.
 25. Butler, J.M., et al., Maternal parenting style and adjustment in adolescents with type I diabetes. *Journal of Pediatric Psychology*, **2007**. 32(10):p. 1227-1237.
 26. Fu, S.L., et al., High quality nursing of children with pneumonia complicated with heart failure. *Journal of Biological Regulators and Homeostatic Agents*, **2019**. 33(3):p. 905-910.
 27. Drew, L.M., et al., The mediating role of extreme peer orientation in the relationships between adolescent-parent relationship and diabetes management. *Journal of Family Psychology*, **2010**. 24(3):p. 299.
 28. Ellis, D.A., et al., The role of parental monitoring in adolescent health outcomes: Impact on regimen adherence in youth with type 1 diabetes. *Journal of pediatric psychology*, **2007**. 32(8):907-917. 32(8): p. 907-17.
 29. Fortenberry, K.T., et al., Perceived diabetes task competence mediates the relationship of both negative and positive affect with blood glucose in adolescents with type 1 diabetes. *Annals of Behavioral Medicine*, **2009**. 37(1):p. 1-9.
 30. Gavin, L., and Wysocki, T., Associations of paternal involvement in disease management with maternal and family outcomes in families with children with chronic illness. *Journal of pediatric psychology*, **2006**. 31(5):p. 481-489.
 31. Horton, D., et al., The role of parental monitoring in metabolic control: Effect on adherence and externalizing behaviors during adolescence. *Journal of pediatric psychology*, **2009**. 34(9):p. 1008-1018.
 32. Kerns, K.A., et al., Parent-child attachment and monitoring in middle childhood. *Journal of family psychology*, **2001**.15(1):p. 69.
 33. Kim, Y.G., et al., The role of inflammasome-dependent and inflammasome-independent NLRP3 in the kidney. *Cells*, **2019**. 8(11):p. 1389.
 34. Luo, B., et al., NLRP3 gene silencing ameliorates diabetic cardiomyopathy in a type 2 diabetes rat model. *PloS one*, **2014**. 9(8):p. e104771.
 35. Zhang, C., et al., Epigallocatechin-3-gallate prevents inflammation and diabetes-induced glucose tolerance through inhibition of NLRP3 inflammasome activation. *International Immunopharmacology*, **2021**. 93:p. 107412.
 36. Ye, T., et al., Gastrodin alleviates cognitive dysfunction and depressive-like behaviors by inhibiting ER stress and NLRP3 inflammasome activation in db/db mice. *International Journal of Molecular Sciences*, **2018**. 19(12):p. 3977.