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CASE REPORT/ OLGU RAPORU

Target Interval Diabetes Monitoring and Nursing Care According to Orem's Self-Care Defisit Theory Through Ambulatory Glucose Profile: A Case Report

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ABSTRACT

With the advancement of technology, individuals with diabetes from all age groups have begun using insulin pumps and continuous glucose monitors. Diabetes nurses provide training on blood glucose measurement, insulin administration, and complication prevention to help individuals with diabetes maintain their self-management and self-care. In addition to these trainings, education on the diabetes technology used by the individual should also be planned. This case report examines the nursing care and diabetes follow-up process of an individual with type 1 diabetes, based on Orem's Self-Care Deficit Theory, using an ambulatory glucose profile. The individual diabetes has been using an insulin pump for fifteen years and an artificial intelligence-based insulin pump with a continuous glucose monitor for four months. Training provided by nurses on the correct use of these technologies plays a crucial role in the individual's diabetes management. During the training process, the individual was guided on topics such as carbohydrate counting, insulin management, and the proper use of the continuous glucose monitor. Following the diabetes follow-up between November-December 2024, significant improvements were observed in the individual's glucose profile. The time spent in the target range increased from 63% to 70%, and hyperglycemia rates decreased significantly. These findings show that diabetes technology training positively impacts the individual's self-care skills and enhances diabetes management. Effective nursing care is a important step toward improving the individual's quality of life and preventing complications.

Keywords: Target interval diabetes monitoring, ambulatory glucose profile, self-care, nursing.

Ambulatuvar Glikoz Profili Üzerinden Orem Öz Bakım Eksikliği Teorisi'ne Göre Hedef Aralıklı Diyabet İzlemi ve Hemşirelik Bakımı: Bir Olgu Sunumu

ÖZET

Teknolojinin gelişimiyle her yaş grubundan diyabetli birey insülin pompası ve sürekli glikoz monitörü kullanmaya başlamıştır. Diyabetli bireylerin öz yönetim ve öz bakımlarını sürdürebilmeleri için kan şekeri ölçümü, insülin uygulamaları, komplikasyon önlemleri gibi eğitimler diyabet hemşireleri tarafından verilmektedir. Bu eğitimlere ek olarak bireyin kullandığı diyabet teknolojisi yönelik eğitim konuları da hemşireler tarafından planlanmalıdır. Bu olgu sunumu, tip 1 diyabetli bir bireyin ambulatuvar glikoz profili üzerinden Orem Öz Bakım Eksikliği Teorisi'ne dayalı hemşirelik bakımı ve diyabet izlem sürecini ele almaktadır. Diyabetli birey; on beş yıldır insülin pompası kullanırken, dört aydır yapay zeka tabanlı insülin pompası ve sürekli glikoz monitörü kullanmaya başlamıştır. Bu teknolojilerin doğru kullanımı için hemşireler tarafından verilen eğitimler, bireyin diyabet yönetiminde önemli bir rol oynamaktadır. Eğitim sürecinde, bireye karbonhidrat sayımı, insülin yönetimi ve sürekli glikoz monitörünün doğru kullanımı gibi konular üzerinden rehberlik yapılmıştır. Kasım -Aralık 2024 tarihleri arasında yapılan diyabet izlemi sonrasında, bireyin glikoz profilinde önemli iyileşmeler gözlemlenmiştir. Hedef aralıkta geçirdiği süre %63'ten %70'e çıkmış, hiperglisemi oranlarında ise belirgin azalmalar saptanmıştır. Bu bulgular, diyabet teknolojileri eğitimlerinin bireyin öz bakım becerilerini olumlu yönde etkilediğini ve diyabet yönetimini iyileştirdiğini göstermektedir. Hemşirelik bakımının etkinliği, bireyin yaşam kalitesini artırmaya ve komplikasyonları engellemeye yönelik önemli bir adımdır.

Anahtar Kelimeler: Hedef aralıklı diyabet izlemi, ambulatuvar glikoz profili, öz bakım, hemşirelik.

1. Introduction

Diabetes mellitus is a disorder of carbohydrate, fat, and protein metabolism characterized by insulin deficiency or insufficiency, leading to hyperglycemia and affecting multiple organs (1). Diabetes education nurses provide training on blood glucose measurement, insulin administration, and the prevention of acute and chronic complications to enhance the self-management and self-care of individuals with diabetes.

Training on insulin pumps and continuous glucose monitors (CGMs) should be included for individuals who use or are about to start using diabetes technology. Recently, many individuals with diabetes, regardless of age, have begun actively using diabetes technologies. Among these, insulin pumps and continuous glucose monitors have been in use for a long time. Insulin pumps deliver basal insulin to regulate fasting blood sugar and bolus insulin for carbohydrate intake. Continuous glucose monitoring systems measure blood glucose every five minutes, eliminating the need for 5–8 daily capillary blood glucose measurements (2). While glycosylated hemoglobin (HbA1c) is a cornerstone of diabetes management, it cannot detect instantaneous blood glucose fluctuations and provides only a three-month average. Continuous glucose monitoring tools, however, offer the gold standard for preventing diabetes complications by revealing real-time glucose variability. They

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enable the calculation of Time in Range (TIR) for individuals using continuous glucose systems. Generally, it is recommended that TIR (70–180 mg/dL) be above 70%, hypoglycemia (<70 mg/dL) be below 5%, and hyperglycemia (>180 mg/dL) be below 25% (3,4).

The increased use of diabetes technologies does not mean that diabetes complications can be prevented, but the correct use of these technologies is critical in reducing the risk of complications. At this stage, diabetes education given to the individual with diabetes using technology plays a key role in ensuring the proper and effective use of these technologgies. These technologies are developed to contribute to the self-management of the individual with diabetes and to improve the quality of life. This also means that they contribute to the self-care of the individual with diabetes (5). The contribution of technology to self-care shows that Orem Self-Care Deficit Theory can be utilized in diabetes education and nursing care. Developed by Dorothea E. Orem in 2001, this theory is widely used in nursing and consists of three components: the theory of self-care, the theory of self-care deficit, and the theory of nursing systems (6). Orem stated that age, gender, developmental status, health status, socio-cultural characteristics, healthcare system, family system, lifestyle, regular activities, self-perception, environmental factors, and the adequacy and accessibility of resources are factors that influence an individual's self-care ability (7) Orem's theory includes six key concepts (self-care, therapeutic self-care needs, self-care power, self-care deficit, nursing power, and nursing system) as well as environmental concepts (basic situational factors) (6). Within the nursing system, Orem's Self-Care Deficit Theory includes the Professional-Technological System (8–11). Orem emphasized that a competent nurse should integrate technology to meet an individual's self-care needs, and it is the nurse's responsibility to learn, teach, and implement technological applications in care by closely following technological advancements (5,9).

2. Material and Method

This case report focuses on target interval diabetes monitoring and nursing care provided to an individual with type 1 diabetes, based on Orem's Self-Care Deficit Theory, using an ambulatory glucose profile. Nursing interventions were applied in November 2024, with evaluations conducted in December 2024. The study adhered to the principles of the Declaration of Helsinki. The patient was informed about the follow-up period from November 1, 2024 to January 1, 2025, and provided both written and verbal informed consent.

3. Case Report

Based on Orem's Self-Care Deficit Theory, factual information is presented in table (Table 1). As shown in the table, a nursing diagnosis of knowledge deficit was identified for the individual with type 1 diabetes. To address this deficit in the use of diabetes technology, training was provided on nutrition, insulin administration timing, carbohydrate counting, and the reading and evaluation of sensor data.

Initially, the daily carbohydrate and insulin values entered into the pump over two weeks were reviewed with the individual during an online interview before the application of the continuous glucose monitor. Additionally, a one-month diabetes follow-up was conducted using the ambulatory glucose profile. The process began with sensor usage training to ensure data accuracy. The individual was educated on reading the ambulatory glucose profile, carbohydrate entry timing, and insulin administration amounts. It was recommended to use the Smart Guard mode 100% of the time and maintain sensor wear for 70–80% of the week. The individual was advised to keep the sensor on continuously and avoid switching to manual mode unless there was a sensor blockage. Furthermore, it was emphasized that the individual should consume at least two liters of water daily to ensure accurate measurements by the continuous glucose monitor. Proper site selection for the continuous glucose monitor and sensor usage duration were highlighted, with the arm or umbilical region recommended as the application site and a sensor usage duration of seven days. The individual was informed to perform capillary glucose measurements at least twice for sensor calibration.

Following the basic pump and sensor training, education on carbohydrate counting and carbohydrate data entry timing was provided. The individual's knowledge of medical nutrition therapy and carbohydrate counting was assessed, and any deficiencies were addressed. Information on acute complications related to sensor use was also provided. Hyperglycemia trends in the ambulatory glucose profile were analyzed, and their causes were investigated. It was determined that these issues stemmed from either not entering carbohydrate intake or entering it late. The individual was advised to enter all carbohydrate intake, organize meal times, input carbohydrate values into the pump at least 10–15 minutes before meals, and, in Smart Guard mode, divide insulin administration into two doses to avoid confusing the pump's algorithm. Training on the signs, symptoms, and prevention of hypoglycemia was also provided, with an emphasis on avoiding the entry of excessive or false carbohydrate data into the pump. Also, the individual was informed that physician consultations were necessary not only for HbA1c measurements but also for monitoring carbohydrate/insulin ratios and TIR status every three months. At the end of the session, the patient was encouraged to ask questions, and necessary explanations were provided.

As a result of the nursing interventions, improvements were observed in the individual's ambulatory glucose profile. TIR

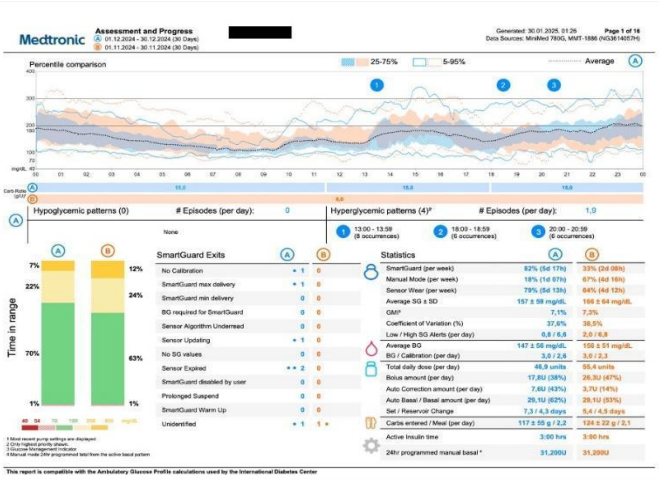

Figure 1. November-December ambulatory glucose profile report of the patient

value increased from 63% in November to 70% in December, indicating a longer duration within the target range. The rate of hyperglycemia between 250–400 mg/dL decreased from 12% to 7%, and the rate between 180–250 mg/dL decreased from 24% to 22%. Although the hyperglycemia rate of 250–400 mg/dL dropped to 7%, the target is below 5%. Upon reviewing carbohydrate entry times and values, it was found that some entries were skipped or entered late, and further education was provided on this topic. The coefficient of variation decreased from 38.5% to 37.6%, and the average blood glucose level decreased from 166 ± 64 mg/dL to 157 ± 59 mg/dL (Figure 1).

4. Discussion

In chronic disease diabetes, the presence of complications, the necessity of continuous medical care and close monitoring increase the importance of self-care management. In order for an individual with diabetes to manage their disease, they need to

develop self-care skills and take responsibility for their own care (12). It is important that individuals with diabetes are supported by information technologies to increase and strengthen their self-management (13). The concepts of technology and self-care are included in Orem's Self-Care Deficit Nursing Theory.

The Self-Care Deficit Nursing Theory has been used in the care of many chronic diseases such as diabetes, epilepsy, and systemic lupus erythematosus (11). This study applied a supportive and educational nursing process based on Orem's Self-Care Deficit Nursing Theory, marking the first instance of nursing care and diabetes monitoring for an individual with type 1 diabetes using an ambulatory glucose profile. The November–December Ambulatory Glucose Profile (AGP) report reflects a one-month diabetes follow-up for the individual who received nursing care in November, according to Orem's Self-Care Deficit Nursing Theory. Identifying barriers in diabetes management is a critical step in achieving optimal health. The main barriers to diabetes self-management include inadequate knowledge, beliefs and behaviors related to diabetes, lack of resources, health problems, negative emotions, and lack of support (14). In this study, it was determined that individuals with diabetes using diabetes technology had a lack of knowledge regarding the use of continuous glucose monitors and insulin pumps. With diabetes self-management education, patients' knowledge and skills are increased, enabling their participation in their own care, thus addressing their self-care deficits (15). Analysis of the individual's glucose profile in November shows that the training positively impacted self-care, as the goal is to achieve a TIR of 70% or higher and a hyperglycemia rate of 180–250 mg/dL below 25% (3). Hypoglycemia levels were also examined, with the percentage between 54–70 mg/dL remaining at 1% in both months, which is acceptable as this range should be below 4% (3). The coefficient of variation decreased from 38.5% to 37.6%, though the target is below 36% (3). The average blood glucose level decreased from 166 ± 64 mg/dL to 157 ± 59 mg/dL, but the target is below 154 mg/dL. Despite a reduction in the total daily insulin dose from 55.4 units to 46.9 units, improvements were observed in the three-month blood glucose average, coefficient of variation, and average blood glucose value. After the training, the individual reported an increased level of knowledge regarding the use of an artificial intelligence-based pump and continuous glucose monitor.

5. Conclusion and Redommendations

The post-training evaluation based on the ambulatory glucose profile concluded that the individual's glucose profile improved. Continuous patient education is essential in managing this disease, which requires ongoing medical care to prevent acute and chronic complications, including long-term retinal, renal, neural, cardiac, and vascular damage.

6. Contribution to the Field

This study is the first in the field of nursing to provide theory-based nursing care using diabetes technology data.

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None.

Conflict of Interest

There is no conflict of interest regarding any person and/or institution.

Authorship Contribution

Concept: GP; **Design:** GP; **Supervision:** EÜA; **Funding:** -; **Materials:** -; **Data Collection/ Processing:** GP, GD, EÜA; **Analysis/Interpretation:** GP, GD, EÜA; **Literature Review:** GP; **Manuscript Writing:** GP, GD, EÜA; **Critical Review:** EÜA.

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Table Appendix 1. Data Collection Form of an Individual with Type 1 Diabetes According to Orem Self-Care Deficit Theory

Basic Situational Factors	
Age:	25
Gender:	Female
Health condition:	Type 1 Diabetes
Development status:	Weight 60 kg; height 158 cm, BMI: 24.09 kg/m²
Socio-cultural characteristics:	The patient lives with her family in Izmir. She has a bachelor's degree, works in the private sector, and her income matches her expenses.
Health care system:	Self-managed
Family system:	Nuclear family
Lifestyle:	The individual spends most of her daytime at the workplace with limited activity due to desk-based working conditions.
Environmental status:	Has a boyfriend and maintains good social relationships.
Availability-adequacy of resources:	She has been using an insulin pump for 15 years and an AI-based pump (with algorithm) and continuous glucose monitor (MiniMed™ 780G) for four months. She receives financial and emotional support from her family.
Other İnformation:	Carbohydrate/insulin ratio: 15; Active insulin duration: 3 hours; IDF: 50; Blood glucose target: 100–120 mg/dL; Basal insulin: 31.2 IU.
Self Care	
The individual is her own self-care agent, as she is healthy and capable of performing self-care activities independently, except during hypoglycemia. She requires support for hyperglycemia management using diabetes technology.	
The Power of Self-Care	
Self-confidence and self-esteem:	Adequate
Ability to control and initiate energy:	Willing
Comprehension proficiency:	Very good
Motivation:	Supported by her mother, father, and boyfriend
Ability to make decisions about self-care:	Can make decisions independently
Ability to obtain and apply technical knowledge:	Moderate
Perceptual, cognitive status and communication skills:	Very good
Ability to regulate self-care behaviors to achieve goals and integrate self-care behaviors into individual and social life:	Modarate
Therapeutic Self-Care Needs	
Self-care needs are examined in three sub-dimensions.	
Universal Self-Care Needs	
Air:	Respiratory findings are normal
Water:	Approximately 2.5 liters per day
Nutrition:	She pays attention to carbohydrate counting but not to food selection. She eats excessively under stress, leading to occasional weight gain. She eats breakfast only on weekends, lunch between 12:00–14:00, and dinner between 19:00–20:00.
Excretion and defecation:	Normal urine and stool control; defecation occurs once daily.
Activity and rest:	She does not engage in regular physical activity. On weekdays, she wakes up at 7:15 AM and sleeps at midnight; on weekends, she stays in bed until noon but still sleeps at midnight.
Protection from hazards:	Risk of accidents and trauma during hypoglycemia.
Social activitie	Engages in activities such as movies, concerts, and vacations.
Improved situations:	Maintains positive relationships with those around her.
Developmental Self-Care Needs	
The individual's physical appearance and cognitive status are appropriate for her developmental stage.	
Divergence from health Self-Care Needs	
Hyperglycemia peaks due to improper use of the pump and continuous glucose monitor; non-compliance with medical nutrition therapy.	
Lack of Self-Care	
The individual experiences self-care deficits due to hyperglycemia and hypoglycemia.	
Nursing Power	
Self-care needs are examined in three sub-dimensions.	
Social System	
Nursing interventions were planned by evaluating the individual's work and home environments.	
Interpersonal System	
She believes she understands diabetes well due to her long experience with type 1 diabetes and trusts diabetes education nurses.	
Professional-technological system	
Errors were identified in the use of the continuous glucose monitor and AI-based pump (MiniMed™ 780G), and technological interventions were implemented.	
Nursing Systems	
According to Orem's theory, there are three nursing systems. The individual with type 1 diabetes using a continuous glucose monitor and AI-based pump (MiniMed™ 780G) has moderate self-care power, requiring supportive and educational nursing approaches.	
Problems Identified by the Nurse	
Lack of knowledge about managing the disease with technology.	