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# IMPLEMENTATION OF NUTRITION CARE PROCESS IN OBESE TYPE 2 DIABETES MELLITUS, DIABETIC NEUROPHATY, FEBRILE SUSPECT URINARY TRACT INFECTION, DIABETIC GASTROPARESIS AND MILD HYPONATREMIA

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**ABSTRACT**

Type 2 diabetes mellitus (T2DM) accompanied by obesity and multiple complications requires individualized and integrated nutrition management. This case study aimed to describe the implementation of the Nutrition Care Process (NCP) in a patient with obese T2DM, diabetic neuropathy, diabetic gastroparesis, febrile suspected urinary tract infection, and mild hyponatremia. A descriptive case study was conducted prospectively during hospitalization using the four stages of the NCP: nutrition assessment, nutrition diagnosis, nutrition intervention, and nutrition monitoring and evaluation. Data were collected through dietary assessment, anthropometric and biochemical measurements, clinical examination, medical records, and nutrition-focused physical assessment, and were analyzed descriptively by comparing conditions before and during nutrition care. The assessment identified excessive energy and macronutrient intake, frequent consumption of sugar-sweetened beverages, limited adherence to previous dietary recommendations, obesity, and severe hyperglycemia. Individualized nutrition intervention was provided through controlled energy and macronutrient intake, dietary modification, nutrition education, and family involvement. During monitoring, dietary intake progressively approached the prescribed requirements, while random blood glucose showed a marked decline during hospitalization. Nausea and abdominal pain resolved, and the patient's general clinical condition improved, although obesity and hyperglycemia persisted at the end of observation. The findings indicate that the NCP is a feasible and clinically useful framework for delivering individualized nutrition care in patients with complex T2DM and multiple comorbidities. Continued nutrition counseling, self-management support, family involvement, and multidisciplinary monitoring are needed to sustain nutritional and metabolic improvements after hospitalization.

**Keywords:** Nutrition Care Process; Type 2 Diabetes Mellitus; Obesity; Medical Nutrition Therapy; Diabetic Gastroparesis

## INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by progressive pancreatic beta-cell dysfunction and insulin resistance, resulting in persistent hyperglycemia and disturbances in carbohydrate, lipid, and protein metabolism. Prolonged hyperglycemia contributes to the development of multiple metabolic abnormalities and increases the risk of both microvascular and macrovascular complications [1]. Obesity is one of the major risk factors for T2DM and may

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further exacerbate insulin resistance, metabolic dysregulation, and difficulties in achieving optimal glycemic control. The increasing coexistence of obesity and T2DM therefore represents a major clinical challenge, requiring comprehensive and individualized management that addresses both metabolic control and nutritional status [2][3].

One of the important chronic complications of T2DM is diabetic neuropathy, which is associated with peripheral nerve damage resulting from prolonged exposure to hyperglycemia and other metabolic disturbances. The pathophysiological mechanisms of diabetic neuropathy involve oxidative stress, chronic inflammation, impaired nerve blood flow, mitochondrial dysfunction, and the accumulation of advanced glycation end products, which collectively contribute to structural and functional nerve impairment [4]. The risk of developing diabetic complications increases in individuals with prolonged duration of diabetes, inadequate glycemic control, obesity, and other metabolic abnormalities. In addition, the presence of multiple comorbidities may further complicate clinical management because nutritional requirements and dietary tolerance can change according to the patient's metabolic and physiological condition.

Diabetes remains a major global public health problem. According to the International Diabetes Federation, more than 537 million adults worldwide were living with diabetes, and this number was projected to increase substantially in the coming decades [5]. In Indonesia, the prevalence of diabetes has also shown an increasing trend, with the 2018 National Basic Health Research reporting a prevalence of 10.9% among individuals aged 15 years and older [6]. Major risk factors for T2DM include obesity, increasing age, family history, unhealthy dietary patterns, physical inactivity, hypertension, dyslipidemia, and metabolic syndrome. These conditions demonstrate the importance of comprehensive management strategies that extend beyond pharmacological treatment and include appropriate nutritional interventions.

Medical Nutrition Therapy (MNT) constitutes an essential component of comprehensive diabetes management. Nutrition interventions for patients with T2DM should not be based on a uniform dietary prescription but should be individualized according to nutritional status, metabolic conditions, personal preferences, lifestyle, and the presence of comorbidities [7][8]. Recent evidence has further emphasized that individualized nutrition therapy can contribute to improved glycemic control, weight management, dietary quality, and overall metabolic outcomes in individuals with T2DM [3][9]. In obese patients, nutrition management should simultaneously consider energy balance, macronutrient distribution, weight reduction, and the prevention of further metabolic complications.

The provision of nutrition therapy becomes more complex when T2DM is accompanied by multiple clinical conditions. Diabetic gastroparesis, for example, may influence gastric emptying and food tolerance, thereby requiring modifications in meal frequency, food texture, and dietary composition [10]. Meanwhile, acute conditions such as

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suspected infection may increase metabolic demands and affect dietary intake. Electrolyte disturbances, including mild hyponatremia, may also require careful monitoring of fluid and nutritional management. Therefore, patients with obesity, T2DM, diabetic complications, gastrointestinal disorders, infection-related conditions, and electrolyte disturbances require an integrated nutrition intervention that is continuously adapted to their changing clinical status.

The Nutrition Care Process (NCP) provides a systematic and standardized framework for delivering individualized nutrition care. The process consists of nutrition assessment, nutrition diagnosis, nutrition intervention, and nutrition monitoring and evaluation, which are implemented through a continuous and interconnected approach [11]. In hospitalized patients with diabetes, nutrition care is particularly important for assessing nutritional risks, determining appropriate energy and nutrient requirements, supporting glycemic management, and adapting interventions according to the patient's clinical condition [12]. Continuous monitoring and reassessment are also necessary because changes in medical conditions, dietary intake, metabolic parameters, and treatment may require modifications to the nutrition intervention.

Nutrition education and behavioral support are additional important components of diabetes care. Structured nutrition education has been associated with improvements in dietary intake, glycemic control, and other metabolic outcomes among patients with T2DM [13][14]. Furthermore, diabetes self-management education and support can improve patients' understanding of their disease and strengthen adherence to dietary and lifestyle recommendations [15]. The effectiveness of nutrition interventions may therefore depend not only on the appropriateness of dietary prescriptions but also on the ability of healthcare professionals to provide individualized education and support that can be implemented by patients.

Despite the growing evidence supporting individualized nutrition therapy in T2DM, limited information is available regarding the practical implementation of the complete Nutrition Care Process in patients presenting with obesity and multiple concurrent complications, including diabetic neuropathy, diabetic gastroparesis, febrile suspected urinary tract infection, and mild hyponatremia. Such clinical complexity requires nutrition care that does not focus exclusively on glycemic control or weight management but also considers gastrointestinal tolerance, metabolic demands, hydration and electrolyte status, and the potential impact of acute and chronic complications. The application of a systematic NCP is therefore important for ensuring that nutrition interventions are based on comprehensive assessment and continuously adjusted according to the patient's clinical response.

Therefore, this article aims to describe the implementation of the Nutrition Care Process in an obese patient with T2DM complicated by diabetic neuropathy, diabetic gastroparesis, febrile suspected urinary tract infection, and mild hyponatremia in a hospital setting. The case was conducted as part of the Clinical

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Professional Practice Program and is intended to demonstrate the application of comprehensive, individualized, and evidence-based clinical nutrition care in managing a patient with complex metabolic and clinical conditions.

## RESEARCH METHODS

### Study Design

This study employed a descriptive case study design using the Nutrition Care Process (NCP) approach. The case was managed prospectively through the four standardized stages of the Nutrition Care Process, namely nutrition assessment, nutrition diagnosis, nutrition intervention, and nutrition monitoring and evaluation. The implementation of nutrition care was conducted over a seven-day observation period during the patient's hospitalization.

### Subject of the Study

The subject of this study was a 52-year-old female patient diagnosed with obese type 2 diabetes mellitus (T2DM) accompanied by diabetic neuropathy, diabetic gastroparesis, febrile suspected urinary tract infection, and mild hyponatremia. The patient was monitored daily throughout the study period to identify changes in nutritional intake, anthropometric parameters, biochemical data, clinical conditions, and nutrition-focused physical findings.

### Data Collection

Data were collected through direct observation, patient interviews, dietary assessment, physical examination, and review of the patient's medical records. Dietary intake was assessed using a 24-hour food recall and a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). The assessment included the patient's habitual dietary pattern, food preferences, and nutrient intake during hospitalization.

Clinical and medical data were obtained from physical examination and medical records, including medical diagnosis, clinical signs and symptoms, biochemical parameters, medication history, and other relevant medical information. Anthropometric assessment was performed to evaluate the patient's nutritional status, while nutrition-focused physical findings were used to identify clinical manifestations related to nutritional problems.

### Nutrition Care Process

The implementation of nutrition care followed the standardized Nutrition Care Process framework. The first stage was nutrition assessment, which included the evaluation of dietary intake, anthropometric measurements, biochemical data, clinical conditions, medical history, and nutrition-focused physical findings.

The second stage was nutrition diagnosis, in which nutrition-related problems were identified and formulated using standardized terminology based on the International Dietetics and Nutrition Terminology (IDNT). Nutrition diagnoses were established based on the relationship between identified nutritional problems, their etiologies, and the supporting signs and symptoms.

The third stage was nutrition intervention. Individualized nutrition interventions were planned and implemented according to the patient's nutritional requirements, medical diagnosis, clinical condition, gastrointestinal tolerance, and dietary intake. The intervention included

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appropriate dietary planning and nutrition education to support the achievement of nutritional and metabolic goals.

The final stage consisted of nutrition monitoring and evaluation. The patient's response to the nutrition intervention was assessed daily by monitoring dietary intake, clinical condition, biochemical parameters, anthropometric indicators, and nutrition-focused physical findings. Changes in these parameters were used to evaluate the effectiveness of the intervention and to determine whether adjustments to the nutrition care plan were required.

**Research Instruments**

The instruments used in this study included standardized Nutrition Care Process (NCP) forms, International Dietetics and Nutrition Terminology (IDNT) guidelines, 24-hour food recall forms, and a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). These instruments were used to systematically collect, document, and evaluate nutritional and clinical information throughout the implementation of the nutrition care process.

**Data Analysis**

Data were analyzed descriptively by comparing the patient's nutritional and clinical condition before, during, and after the implementation of the nutrition intervention. The analysis focused on changes in dietary and nutrient intake, anthropometric parameters, biochemical data, clinical signs and symptoms, and nutrition-focused physical findings. The findings were subsequently interpreted to describe the patient's response to the implemented Nutrition Care Process.

**CASE DESCRIPTION**

**Patient Characteristics**

The patient was admitted to the hospital on November 7, 2025. The subject was a 52-year-old female of Makassar ethnicity who communicated using the Indonesian language. She had completed senior high school education and worked as a farmer. During hospitalization, the patient's mobility was classified as bed rest; however, she was able to get out of bed independently when necessary.

**Clinical Presentation and Medical Diagnosis**

The patient was admitted with chief complaints of fever, chills, generalized body pain, epigastric pain, nausea, and weakness that had persisted for approximately three days before hospital admission. Based on medical examination, the patient was diagnosed with obese type 2 diabetes mellitus, diabetic neuropathy, diabetic gastroparesis, febrile suspected urinary tract infection, and mild hyponatremia.

During hospitalization, the patient's general condition was classified as moderately ill. The patient was fully conscious with a Glasgow Coma Scale (GCS) score of 15 (compos mentis) and showed no signs of edema.

**Medical and Family History**

The patient had been diagnosed with type 2 diabetes mellitus approximately three years before the current hospitalization. She had previously been prescribed metformin at a dose of 500 mg; however, the medication was not consumed regularly. The patient reported no history of other chronic diseases.

Family history revealed that one of the patient's siblings had been diagnosed with type 2 diabetes mellitus, suggesting

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the presence of a familial risk factor for the disease.

**Social and Lifestyle History**

The patient worked as a farmer and lived with her four children. The patient reported no history of smoking or alcohol consumption. Information regarding the patient's social and lifestyle conditions was considered relevant in assessing factors that could influence dietary patterns, adherence to medical treatment, and the implementation of nutrition interventions.

## RESEARCH RESULTS

### Nutrition Assessment

**Dietary History**

Before hospitalization, the patient reported consuming three main meals per day, with approximately two plates of rice at each meal. The primary sources of animal protein were fish, consumed approximately 3–4 times per week, followed by eggs and chicken, which were consumed 2–3 times per week. Meat was consumed infrequently, approximately once per month. Plant-based protein sources, particularly tempeh and tofu, were routinely consumed approximately 3–4 times per week.

The patient's vegetable intake was relatively diverse and included kale, moringa leaves, spinach, carrots, mustard greens, cucumber, and green beans. Fruit consumption included papaya, pear, oranges, pineapple, watermelon, and bananas, generally consumed 2–3 times per week.

The patient also reported a habitual intake of sweetened beverages. She consumed tea containing approximately two tablespoons of sugar daily and syrup mixed with sweetened condensed milk approximately 2–3 glasses per day after farming activities. This dietary pattern indicated a relatively high intake of added sugars and simple carbohydrates, which may have contributed to poor glycemic control.

After being diagnosed with T2DM approximately three years before hospitalization, the patient reported reducing her rice intake to approximately one plate per meal. However, adherence to other dietary recommendations for diabetes management remained inadequate, particularly regarding the consumption of sugar-sweetened beverages and dietary portion control.

Based on the 24-hour food recall before the nutrition intervention, the patient's nutrient intake exceeded the prescribed nutritional requirements. Energy intake was 1,844.6 kcal (143.8%), protein intake was 77.9 g (180.4%), fat intake was 68.1 g (191.0%), and carbohydrate intake was 240.2 g (122.1%). These findings indicated excessive energy and macronutrient intake, particularly protein and fat, relative to the patient's calculated nutritional requirements.

**Anthropometric Assessment**

The patient's height was 160 cm and body weight was 70 kg. Her calculated BMI was 27.3 kg/m², with an estimated ideal body weight of 54 kg. Based on the nutritional status classification applied in this study, the patient was classified as obese.

**Table 1.** Anthropometric Assessment

| Parameter | Result |
|---|---|
| Height | 160 cm |
| Body weight | 70 kg |
| BMI | 27.3 kg/m² |
| Ideal body weight | 54 kg |
| Nutritional status | Obese |

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*Source: Primary Data, 2025.*

**Biochemical Assessment**

The patient's biochemical examination showed marked hyperglycemia, with a random blood glucose level of 613 mg/dL and an HbA1c level of >15%. These findings indicated severe and prolonged hyperglycemia. Serum sodium was 131 mmol/L, indicating mild hyponatremia. Urea was slightly elevated at 26.5 mg/dL, whereas creatinine was within the stated reference range at 0.96 mg/dL. Potassium and chloride levels were within the reference ranges.

**Table 2.** Biochemical Assessment

| Parameter | Result | Reference Value | Interpretation |
|---|---|---|---|
| Random blood glucose | 613 mg/dL | 70–140 mg/dL | Markedly elevated |
| HbA1c | >15% | 4–6% | Markedly elevated |
| Hemoglobin | 5.8* | 12–14 g/dL | Abnormal |
| Creatinine | 0.96 mg/dL | 0.6–1.2 mg/dL | Normal |
| Urea | 26.5 mg/dL | 8–25 mg/dL | Slightly elevated |
| Sodium | 131 mmol/L | 135–145 mmol/L | Mild hyponatremia |
| Potassium | 3.7 mmol/L | 3.5–5.0 mmol/L | Normal |
| Chloride | 101 mmol/L | 94–111 mmol/L | Normal |

*Source: Secondary Data, 2026.*

**Nutrition-Focused Physical Assessment**

The nutrition-focused physical examination showed a weak general condition, while the patient remained fully conscious (compos mentis). The patient reported lower abdominal pain, consistent with gastrointestinal/abdominal discomfort. Appetite was reported as good, and no edema was observed. Blood pressure was 104/83 mmHg, pulse rate was 83 beats/minute, and body temperature was 36.6°C. The respiratory rate was 24 breaths/minute and was considered slightly elevated according to the reference used.

**Table 3.** Nutrition-Focused Physical Assessment

| Parameter | Result | Interpretation |
|---|---|---|
| General condition | Weak | Weak general condition |
| Consciousness | Compos mentis | Normal |
| Abdominal pain | Lower abdominal pain | Present |
| Appetite | Good | Adequate |
| Edema | None | Normal |
| Blood pressure | 104/83 mmHg | Within acceptable range |
| Pulse rate | 83 beats/minute | Normal |
| Respiratory rate | 24 breaths/minute | Slightly elevated |
| Body temperature | 36.6°C | Normal |

*Source: Secondary Data, 2026.*

**Nutrition Diagnosis**

Based on the findings from the nutrition assessment, three nutrition diagnoses were identified using standardized Nutrition Care Process terminology:

NI-2.2 Excessive oral intake related to difficulty limiting food and beverage intake, as evidenced by energy intake of 1,844.6 kcal (143.8%), protein intake of 77.9 g (180.4%), fat intake of 68.1 g (191.0%), and carbohydrate intake of 240.2 g (122.1%) relative to the patient's estimated requirements.

NC-2.2 Altered nutrition-related laboratory values related to impaired glucose regulation and metabolic disturbances, as evidenced by a random blood glucose level of 613 mg/dL and

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HbA1c >15%. The patient's sodium level of 131 mmol/L also indicated mild hyponatremia.

NB-1.6 Limited adherence to nutrition-related recommendations related to inadequate application of previously received nutrition information, as evidenced by a history of continued consumption of sugar-sweetened beverages and markedly elevated HbA1c (>15%).

**Nutrition Intervention**

The patient received individualized nutrition intervention based on the principles of diabetes nutrition management and the 2024 guidelines of the Indonesian Endocrinology Association (PERKENI). The diet was provided orally using a regular food consistency because the patient was able to eat independently and had no reported swallowing difficulties.

The nutrition intervention aimed to provide adequate energy and nutrient intake according to the patient's nutritional requirements, improve glycemic control, support appropriate body-weight management, prevent further metabolic complications, and support recovery from the patient's acute and chronic clinical conditions.

The prescribed nutritional composition consisted of approximately 1,282.5 kcal of energy, 43.2 g of protein, 35.6 g of fat, and 197.5 g of carbohydrates. The implemented diet provided approximately 1,282.0 kcal of energy, 44.3 g of protein, 36.1 g of fat, and 200.3 g of carbohydrates.

**Table 4.** Prescribed and Implemented Nutritional Intake

| Nutrient | Requirement | Implementation |
|---|---|---|
| Energy (kcal) | 1,282.5 | 1,282.0 |
| Protein (g) | 43.2 | 44.3 |
| Fat (g) | 35.6 | 36.1 |
| Carbohydrate (g) | 197.5 | 200.3 |

*Source: Primary Data, 2025.*

Nutrition education was provided to the patient and family caregivers to improve understanding and adherence to diabetes dietary management. Education covered meal timing, portion control, appropriate food selection, and the limitation of sugar-sweetened foods and beverages. Educational leaflets and food exchange lists were used to facilitate understanding and practical application of the recommended diet.

The patient was encouraged to limit simple sugars and saturated fat, select complex carbohydrate sources with adequate dietary fiber, increase vegetable consumption, regulate meal portions, and maintain consistency in meal timing. Family involvement was emphasized to support adherence to the recommended dietary pattern after discharge.

**Nutrition Monitoring and Evaluation**

**Nutrient Intake Monitoring**

Daily monitoring demonstrated a progressive reduction in energy and macronutrient intake toward the prescribed nutritional requirements. Compared with the pre-intervention intake, energy intake decreased from 1,844.6 kcal (143.8%) to 1,344.8 kcal (104.9%) on Day 6. Protein intake decreased from 77.9 g (180.4%) to 48.2 g (111.8%), while fat intake decreased from 68.1 g (191.0%) to 40.5 g (115.9%). Carbohydrate intake decreased from 240.2 g (122.1%) to 201.8 g (102.1%).

Although intake remained slightly above the prescribed requirements on Day

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6, the overall trend indicated improved dietary adherence and greater alignment with the patient's nutritional prescription.

**Table 5.** Daily Nutrient Intake Monitoring

| Monitoring Period | Energy | Protein | Fat |
|---|---|---|---|
| Before intervention | 1,844.6 kcal (143.8%) | 77.9 g (180.4%) | 68.1 g (191.0%) |
| Day 1 | 1,563.8 kcal (121.9%) | 61.6 g (142.6%) | 42.5 g (119.5%) |
| Day 2 | 1,483.9 kcal (115.7%) | 52.8 g (122.4%) | 55.2 g (155.2%) |
| Day 3 | 1,499.8 kcal (117.0%) | 58.2 g (134.6%) | 53.5 g (153.0%) |
| Day 4 | 1,366.4 kcal (106.5%) | 49.2 g (113.9%) | 36.1 g (103.3%) |
| Day 5 | 1,373.4 kcal (101.3%) | 51.4 g (119.4%) | 33.4 g (95.6%) |
| Day 6 | 1,344.8 kcal (104.9%) | 48.2 g (111.8%) | 40.5 g (115.9%) |

*Source: Primary Data, 2026.*

**Anthropometric Monitoring**

Anthropometric monitoring showed a slight increase in body weight from 70.0 kg before the intervention to 70.5 kg on Day 6. Consequently, BMI increased slightly from 27.3 to 27.5 kg/m², while the patient's nutritional status remained classified as obese. The small increase in body weight over the six-day period may reflect short-term changes in hydration status and does not necessarily represent an increase in adipose tissue.

**Table 6.** Anthropometric Monitoring

| Parameter | Before Intervention | Day 6 | Evaluation |
|---|---|---|---|
| Body weight | 70.0 kg | 70.5 kg | Increased by 0.5 kg |
| Height | 160 cm | 160 cm | No change |
| BMI | 27.3 kg/m² | 27.5 kg/m² | Slight increase |
| Nutritional status | Obese | Obese | Unchanged |

*Source: Primary Data, 2025.*

**Biochemical Monitoring**

Random blood glucose showed a consistent decline throughout the six-day nutrition intervention period. The patient's random blood glucose decreased from 613 mg/dL before intervention to 587 mg/dL on Day 1, 474 mg/dL on Day 2, 387 mg/dL on Day 3, 311 mg/dL on Day 4, 233 mg/dL on Day 5, and 220 mg/dL on Day 6.

Overall, random blood glucose decreased by 393 mg/dL, representing an approximately 64.1% reduction from baseline. Despite this substantial improvement, the Day 6 glucose level remained above the stated reference range, indicating that hyperglycemia had improved but had not yet reached the desired level during the observation period.

**Table 7.** Random Blood Glucose Monitoring

| Monitoring Period | Random Blood Glucose |
|---|---|
| Before intervention | 613 mg/dL |
| Day 1 | 587 mg/dL |
| Day 2 | 474 mg/dL |
| Day 3 | 387 mg/dL |
| Day 4 | 311 mg/dL |
| Day 5 | 233 mg/dL |
| Day 6 | 220 mg/dL |

*Source: Primary Data, 2025.*

**Nutrition-Focused Physical Monitoring**

Nutrition-focused physical monitoring demonstrated improvement in the patient's general clinical condition during the intervention period. The patient's general condition changed from weak before intervention to good on Day 6. Abdominal pain, which was present at baseline and persisted on Day 3, was no longer reported on Day 6. Nausea was also

present at baseline but had resolved by Day 3 and remained absent on Day 6.

The patient's pulse rate decreased from 119 beats/minute at baseline to 83 beats/minute on Day 3 and 65 beats/minute on Day 6. Respiratory rate decreased from 24 breaths/minute on Day 3 to 19 breaths/minute on Day 6. Body temperature remained stable at approximately 36.6–36.7°C, while oxygen saturation remained at 98% throughout monitoring.

**Table 8.** Nutrition-Focused Physical Monitoring

| Parameter | Before Intervention | Day 3 | Day 6 |
|---|---|---|---|
| General condition | Weak | Weak | Good |
| Consciousness | Compos mentis | Compos mentis | Compos mentis |
| Abdominal pain | Present | Present | Absent |
| Nausea | Present | Absent | Absent |
| Blood pressure | 104/83 mmHg | 153/86 mmHg | 129/75 mmHg |
| Pulse rate | 119 beats/minute | 83 beats/minute | 65 beats/minute |
| Respiratory rate | 20 breaths/minute | 24 breaths/minute | 19 breaths/minute |
| Body temperature | 36.6°C | 36.6°C | 36.7°C |
| $SpO_2$ | 98% | 98% | 98% |

*Source: Secondary Data, 2026.*

Overall, the seven-day Nutrition Care Process demonstrated improvement in dietary intake, glycemic status, and several nutrition-related clinical findings. The most prominent biochemical change was the progressive reduction in random blood glucose from 613 mg/dL to 220 mg/dL. Dietary intake also became progressively closer to the prescribed nutritional requirements. However, the patient's nutritional status remained obese, and hyperglycemia persisted at the end of the monitoring period, indicating the need for continued nutritional management and clinical monitoring.

## DISCUSSION

The findings of this case demonstrate that the implementation of the Nutrition Care Process (NCP) can provide a structured framework for addressing the complex nutritional problems of a patient with obesity, type 2 diabetes mellitus (T2DM), diabetic neuropathy, diabetic gastroparesis, suspected urinary tract infection, and mild hyponatremia. The patient's initial condition reflected the interaction of several nutrition-related problems, including excessive energy and macronutrient intake, poor adherence to dietary recommendations, severe hyperglycemia, obesity, and gastrointestinal symptoms. Therefore, the nutritional problem in this case cannot be understood solely as excessive food intake but rather as a combination of inappropriate dietary behavior, inadequate diabetes self-management, and the metabolic burden associated with multiple comorbidities. This supports the concept that nutrition therapy for diabetes should be individualized according to metabolic status, nutritional requirements, lifestyle, food preferences, and associated clinical conditions rather than relying on a uniform dietary prescription [7][8][9].

### Dietary Pattern and Nutritional Problems

The dietary assessment identified a substantial discrepancy between the patient's habitual intake and her estimated nutritional requirements. Before intervention, energy, protein, fat, and

carbohydrate intakes were considerably higher than prescribed. The most clinically relevant dietary behavior was the regular consumption of sugar-containing beverages, particularly tea with added sugar and syrup combined with sweetened condensed milk. Although the patient had reduced her rice intake after being diagnosed with T2DM, this modification alone was insufficient to achieve adequate dietary control because the consumption of added sugars and excessive portions remained. This finding illustrates an important limitation of disease-specific dietary behavior: patients may perceive a reduction in staple carbohydrate intake as sufficient diabetes management while overlooking other sources of energy and rapidly absorbed carbohydrates.

The patient's dietary pattern is consistent with the principle of individualized medical nutrition therapy, in which dietary counseling should consider the patient's habitual eating behavior and identify practical sources of excessive energy or carbohydrate intake [7][8]. Barrea et al. [3] emphasized that nutrition therapy for T2DM requires a comprehensive approach involving dietary quality, energy balance, macronutrient distribution, and lifestyle factors. Similarly, personalized nutrition approaches emphasize the importance of adapting dietary recommendations to individual characteristics and behaviors rather than applying identical dietary prescriptions to all patients with diabetes [9]. In this case, the nutritional intervention therefore appropriately focused not only on reducing the quantity of food consumed but also on modifying the quality and pattern of food and beverage consumption.

The patient's obesity further strengthened the rationale for energy control. With a body weight of 70 kg and a BMI of 27.3 kg/m², the patient had excess body weight that could contribute to insulin resistance and impaired glycemic regulation. Obesity is closely associated with T2DM and may make glycemic management more difficult because excess adiposity contributes to metabolic dysfunction [2][3]. Consequently, the nutritional intervention needed to balance two potentially competing objectives: reducing excessive energy intake while ensuring that nutrient provision remained adequate to support recovery during hospitalization. The prescribed energy intake of approximately 1,282.5 kcal represented a substantial reduction from the patient's habitual intake, while the prescribed macronutrient distribution provided a more controlled dietary pattern.

**Nutrition Diagnosis and Individualized Intervention**

The three nutrition diagnoses identified in this case provide an important explanation of the relationship between the patient's dietary behavior and clinical condition. Excessive oral intake was supported by the high pre-intervention intake of energy and macronutrients. Altered nutrition-related laboratory values were demonstrated primarily by severe hyperglycemia, while limited adherence to nutrition-related recommendations was reflected by the continued consumption of sugar-sweetened beverages despite a previous diagnosis of T2DM. These diagnoses demonstrate the usefulness of the NCP in moving beyond medical diagnoses toward problems that can be directly addressed through nutrition intervention.

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The NCP emphasizes a systematic process beginning with comprehensive assessment, followed by identification of nutrition-related diagnoses, implementation of targeted interventions, and continuous monitoring and evaluation [11]. In this case, this sequence was particularly relevant because the patient's nutritional problems were interconnected. Excessive intake contributed to poor metabolic control, while limited adherence reduced the effectiveness of previous dietary recommendations. The intervention therefore required both a quantitative component, through adjustment of energy and macronutrient intake, and a behavioral component, through nutrition education and family involvement.

The implemented diet was closely aligned with the prescribed nutritional requirements. The difference between the prescribed and implemented intake was relatively small, indicating that the hospital diet was feasible for the patient to consume. More importantly, the progressive reduction in nutrient intake during monitoring suggests that the patient was able to adapt to the recommended dietary pattern. By Day 6, energy intake had decreased to 104.9% of the requirement, protein to 111.8%, fat to 115.9%, and carbohydrate to 102.1%. Although several nutrients remained slightly above the calculated requirements, the direction of change indicates improved adherence compared with the pre-intervention condition.

These findings are consistent with previous evidence showing that nutrition education and structured dietary intervention can improve dietary intake and metabolic outcomes among patients with T2DM [13][14]. The effectiveness of nutrition education is particularly important in this case because the patient's previous dietary behavior suggested that knowledge had not been fully translated into daily practice. Diabetes self-management education is intended not merely to provide information but also to support patients in acquiring the skills and confidence necessary to apply recommendations in everyday life [15]. Accordingly, the involvement of family caregivers in the present intervention was clinically relevant because dietary adherence after discharge will depend partly on the patient's household food environment.

**Glycemic Response to Nutrition Care**

The most prominent clinical change during the monitoring period was the progressive reduction in random blood glucose from 613 mg/dL at baseline to 220 mg/dL on Day 6. This substantial improvement occurred concurrently with the reduction in energy and macronutrient intake and the implementation of structured diabetes nutrition therapy. The finding indicates that the overall inpatient management, including nutritional intervention, was associated with a marked improvement in glycemic status.

Nevertheless, the reduction in blood glucose should be interpreted cautiously. A case study cannot establish that nutrition intervention alone caused the observed decline because hospitalized patients with severe hyperglycemia commonly receive simultaneous medical treatment, including glucose-lowering medication, fluid management, treatment of infection, and other clinical interventions. Therefore, the observed improvement should be interpreted as a response to integrated

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inpatient management in which nutrition care constituted an important component rather than as an isolated nutritional effect.

This interpretation is consistent with the role of medical nutrition therapy in hospitalized patients with diabetes. Nutrition therapy is intended to support metabolic control while meeting the nutritional demands associated with illness and recovery, and it should be coordinated with medical management [12]. The patient's initial glucose concentration of 613 mg/dL and HbA1c level above 15% indicate that the metabolic disturbance had developed over a prolonged period and could not reasonably be expected to normalize within several days through dietary intervention alone. The fact that glucose remained at 220 mg/dL on Day 6 reinforces the importance of continued nutritional and medical management after the acute hospitalization.

The patient's HbA1c level also provides an important interpretation of the case. Whereas random blood glucose reflects the patient's current metabolic state, HbA1c >15% indicates prolonged and severe glycemic dysregulation. Thus, the reduction in random blood glucose during hospitalization represents an acute improvement but should not be interpreted as complete resolution of the underlying diabetes problem. Long-term glycemic management requires sustained adherence to dietary recommendations, appropriate pharmacological treatment, physical activity, and self-management support [1][15].

**Relationship Between Nutrition Care and Gastrointestinal Symptoms**

The presence of diabetic gastroparesis adds complexity to the nutritional management of this patient. Gastroparesis can interfere with gastric emptying and may contribute to nausea, abdominal discomfort, early satiety, and impaired tolerance of meals [10]. In the present case, nausea and abdominal pain were present at baseline but resolved during the monitoring period. The improvement in gastrointestinal symptoms occurred alongside the implementation of a controlled hospital diet and the patient's overall clinical recovery.

The resolution of nausea and abdominal pain suggests that the intervention was tolerated clinically. However, because the patient retained a good appetite and was able to consume food orally, there was no indication in this case for enteral or parenteral nutritional support. The use of regular oral food consistency was therefore appropriate based on the patient's functional ability and absence of swallowing difficulties. Nevertheless, gastroparesis requires continued attention to meal size, frequency, dietary composition, and tolerance because a diet that is nutritionally appropriate for diabetes may not necessarily be optimally tolerated by a patient with delayed gastric emptying [10].

This finding highlights the importance of integrating comorbidities into the NCP rather than treating each diagnosis independently. A purely diabetes-oriented intervention could focus on carbohydrate restriction and glycemic control while overlooking gastrointestinal tolerance. Conversely, an intervention focused exclusively on gastroparesis could fail to address the patient's severe obesity and hyperglycemia. The strength of the NCP in this context lies in its ability to

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integrate these competing nutritional considerations into one individualized care plan [11].

**Obesity and Anthropometric Response**

Despite improvements in dietary intake and blood glucose, the patient's body weight increased slightly from 70.0 kg to 70.5 kg, with BMI increasing from 27.3 to 27.5 kg/m². This finding does not necessarily indicate failure of the nutrition intervention. A six-day hospitalization is too short to evaluate meaningful changes in adipose tissue, particularly when the patient is experiencing acute illness and changes in fluid balance. Short-term changes in body weight may reflect hydration status, fluid administration, gastrointestinal contents, or other physiological factors rather than changes in body fat.

The persistence of obesity at the end of the observation period nevertheless indicates that weight management remains an important long-term objective. Nutrition therapy for patients with obesity and T2DM should address sustainable energy control rather than expect substantial weight reduction during a short inpatient period [2][3]. The immediate objective in the hospital should therefore be safe nutritional provision and metabolic stabilization, while longer-term weight management should be continued through outpatient nutrition counseling, physical activity, behavioral modification, and regular monitoring.

**Clinical Improvement and the Role of Integrated Care**

The nutrition-focused physical findings also demonstrated general clinical improvement. The patient's general condition changed from weak to good, abdominal pain resolved, nausea disappeared, and pulse and respiratory rates improved during the observation period. These changes are clinically encouraging because they occurred simultaneously with improvements in dietary intake and glycemic status. However, similar to the interpretation of blood glucose, these outcomes cannot be attributed exclusively to nutrition intervention because the patient was simultaneously receiving comprehensive medical care for acute and chronic conditions.

The suspected urinary tract infection is particularly relevant in interpreting the clinical response. Acute infection can increase metabolic stress and may worsen glycemic control, while severe hyperglycemia can adversely affect the body's ability to respond to infection. Therefore, improvement in the acute infectious condition and improved glycemic management may have influenced each other. The NCP consequently functioned as part of multidisciplinary care rather than as a stand-alone intervention. Nutrition professionals need to coordinate dietary management with physicians, nurses, pharmacists, and other healthcare professionals to ensure that nutrition recommendations remain consistent with the patient's overall medical treatment [12].

The patient's mild hyponatremia, with a sodium concentration of 131 mmol/L, also demonstrates the importance of interpreting laboratory abnormalities within the broader clinical context. In patients with marked hyperglycemia, serum sodium concentration may be affected by osmotic shifts associated with elevated glucose. Therefore, sodium abnormalities should not automatically be interpreted as an isolated dietary sodium problem. The

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appropriate response is careful clinical and biochemical monitoring and coordination with the medical team rather than indiscriminate dietary modification. This further supports the need for comprehensive assessment within the NCP framework.

**Nutrition Education, Adherence, and Family Involvement**

An important component of this case was the provision of nutrition education to the patient and family caregivers. The intervention addressed meal timing, portion control, food selection, reduction of simple sugars and saturated fat, selection of complex carbohydrate sources, vegetable consumption, and consistency of dietary intake. These educational components directly addressed the behavioral factors identified during the assessment, particularly the continued consumption of sugar-sweetened beverages.

The need for this education is reinforced by the patient's history of irregular diabetes medication use and persistent dietary practices inconsistent with diabetes management. Her markedly elevated HbA1c suggests that poor glycemic control was not simply an acute consequence of hospitalization but reflected inadequate long-term disease management. Structured nutrition education has been associated with improvements in dietary intake and glycemic control in patients with T2DM [13], while broader lifestyle interventions incorporating nutrition education have demonstrated beneficial effects on diabetes-related outcomes [14]. Diabetes self-management education and support similarly emphasize sustained patient participation in dietary and lifestyle management rather than passive receipt of information [15].

Family involvement may be particularly important in this case because the patient lives with four children and dietary practices are often influenced by the household food environment. Nutrition education directed toward both the patient and caregivers can improve the likelihood that recommended dietary changes will continue after discharge. The education should therefore extend beyond hospital-specific meal plans and emphasize practical substitutions, reduction of sugar-sweetened beverages, appropriate portion sizes, and culturally acceptable food choices that can realistically be maintained in the patient's daily life.

**Implications for Clinical Nutrition Practice**

The findings provide several practical implications for clinical nutrition services. First, nutritional assessment in hospitalized patients with T2DM should extend beyond a single-day food intake assessment and include habitual dietary behavior, beverage consumption, adherence history, anthropometric status, biochemical abnormalities, gastrointestinal symptoms, and comorbidities. In this case, the major behavioral contributor to poor glycemic control would have been underestimated if the assessment had focused only on rice consumption.

Second, nutrition interventions should be individualized and continuously reassessed. The progressive movement of nutrient intake toward the prescribed requirements demonstrates that dietary prescriptions can be implemented successfully when accompanied by

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monitoring and education. However, the persistence of hyperglycemia and obesity demonstrates that short-term improvement in inpatient indicators does not eliminate the need for long-term nutrition care.

Third, the case highlights the importance of multidisciplinary coordination. Severe hyperglycemia, diabetic gastroparesis, suspected infection, and hyponatremia represent clinical conditions that cannot be managed through dietary intervention alone. Nutrition care should therefore be integrated with medical treatment and adjusted according to changes in glucose levels, gastrointestinal tolerance, hydration status, laboratory findings, and clinical recovery [12].

**Limitations of the Case**

Several limitations should be considered when interpreting these findings. First, this was a single-patient descriptive case study with a relatively short observation period. Consequently, the findings cannot be generalized to all patients with T2DM and multiple comorbidities. Second, the marked reduction in blood glucose occurred in the context of comprehensive hospital treatment, making it impossible to isolate the independent effect of nutrition intervention. Third, the six-day anthropometric observation period was insufficient to evaluate meaningful changes in body composition or long-term obesity management. Fourth, the assessment relied partly on patient-reported dietary information, which may be affected by recall error and reporting bias. Finally, the long-term sustainability of the patient's dietary adherence after discharge was not evaluated.

Despite these limitations, the case provides a practical illustration of how the NCP can translate a complex clinical presentation into specific nutrition diagnoses, individualized interventions, and measurable monitoring outcomes. The principal contribution of this case is not the demonstration of a causal effect of nutrition therapy on blood glucose but the illustration of how systematic nutrition care can be integrated into the management of a patient whose diabetes is complicated by obesity, gastrointestinal dysfunction, neurological complications, acute infection-related illness, and electrolyte disturbance.

Overall, the findings support the use of the Nutrition Care Process as a clinically useful framework for managing complex patients with T2DM. The progressive improvement in dietary intake, marked reduction in random blood glucose, resolution of nausea and abdominal pain, and improvement in general clinical condition suggest that individualized nutrition care was feasible and clinically supportive during hospitalization. However, persistent hyperglycemia and obesity indicate that inpatient improvement should be viewed as an initial stage of a longer continuum of care. Continued nutrition counseling, diabetes self-management education, family support, monitoring of glycemic status and body weight, and coordination with medical treatment are necessary to sustain and extend the benefits achieved during hospitalization.

## CONCLUSION

The implementation of the Nutrition Care Process provided a systematic and individualized approach to addressing the

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nutritional problems of a patient with obese type 2 diabetes mellitus and multiple concurrent complications. Comprehensive assessment identified excessive dietary intake, frequent consumption of sugar-sweetened beverages, limited adherence to dietary recommendations, severe hyperglycemia, and gastrointestinal symptoms, which were subsequently addressed through individualized dietary planning, nutrition education, and family involvement. During the intervention period, dietary intake became more closely aligned with nutritional requirements, glycemic status improved substantially, and gastrointestinal symptoms and general clinical condition showed improvement, although obesity and hyperglycemia remained unresolved. These findings support the practical value of the Nutrition Care Process as part of integrated multidisciplinary management for complex diabetic patients, while recognizing that short-term clinical improvements cannot be attributed to nutrition intervention alone. Continued nutrition care after hospitalization should focus on sustained dietary adherence, reduction of sugar-sweetened beverage consumption, long-term weight management, diabetes self-management education, family support, and regular monitoring of metabolic and clinical conditions to maintain and improve the patient's health outcomes.

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