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Laporan Kes / *Case Report*

Exclusive Enteral Nutrition And The Crohn's Disease Exclusion Diet In The Nutritional Management Of Crohn's Disease

Pemakanan Enteral Eksklusif dan Diet Pengecualian Penyakit Crohn dalam Pengurusan Pemakanan Penyakit Crohn

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ABSTRACT

Crohn's disease is a chronic inflammatory condition affecting the gastrointestinal tract, often leading to serious complications that impact quality of life. Nutritional therapy is increasingly recognized as an important component of management due to its role in inducing remission, improving nutritional status, and supporting growth. This case study aims to describe the nutritional management of a 17-year-old boy with refractory Crohn's disease, growth failure, and iron deficiency anemia. On admission, he presented with significant undernutrition, including a body mass index below the 3rd percentile and 18% weight loss within eight months. Nutritional intervention involved transitioning from a standard to a semi-elemental enteral formula to enhance gastrointestinal tolerance and optimize energy and protein intake. Exclusive enteral nutrition was subsequently initiated as a primary therapeutic strategy, before progressing to a structured exclusion diet tailored to minimize symptom triggers and support long-term disease control. Ongoing monitoring, individualized dietary education, and close follow-up led to notable improvements in weight status, symptom control, and overall nutritional adequacy. This case highlights the effectiveness of structured dietary strategies in the comprehensive management of Crohn's disease, particularly in pediatric patients with growth and nutritional challenges.

Keywords: Crohn's disease, nutritional therapy, enteral nutrition, exclusion diet, pediatric nutrition management.

ABSTRAK

Penyakit Crohn merupakan keadaan keradangan kronik yang menjejaskan saluran gastrousus, dan sering membawa kepada komplikasi serius yang menimpactkan kualiti hidup. Terapi pemakanan semakin diiktiraf sebagai komponen penting dalam pengurusan kerana peranannya dalam menggalakkan pengampunan penyakit, memperbaiki status pemakanan, serta menyokong pertumbuhan. Kajian kes ini bertujuan untuk menerangkan pengurusan pemakanan bagi seorang remaja lelaki berusia 17 tahun dengan penyakit Crohn refraktori, kegagalan tumbesaran, dan anemia kekurangan zat besi. Semasa kemasukan ke hospital, beliau menunjukkan tanda-tanda kekurangan zat pemakanan yang ketara, termasuk indeks jisim badan di bawah persentil ke-3 dan penurunan berat badan sebanyak 18% dalam tempoh lapan bulan. Intervensi pemakanan melibatkan peralihan daripada formula enteral standard kepada formula semi-elemen bagi meningkatkan toleransi gastrousus serta mengoptimumkan pengambilan tenaga dan protein. Pemakanan enteral eksklusif kemudiannya dimulakan sebagai strategi terapeutik utama, sebelum beralih kepada diet pengecualian berstruktur yang disesuaikan untuk meminimumkan pencetus simptom serta menyokong kawalan penyakit jangka panjang. Pemantauan berterusan, pendidikan diet secara individu, dan susulan rapi telah membawa kepada peningkatan ketara dalam status berat badan, kawalan simptom, serta kecukupan pemakanan secara keseluruhan. Kajian kes ini menekankan keberkesanan strategi diet berstruktur

dalam pengurusan menyeluruh penyakit Crohn, khususnya dalam kalangan pesakit pediatrik dengan cabaran tumbesaran dan pemakanan.

Kata kunci: Penyakit Crohn, terapi pemakanan, pemakanan enteral, diet pengecualian, pengurusan pemakanan pediatrik

INTRODUCTION

Crohn's disease is a long-term inflammatory disorder that primarily affects the gastrointestinal tract, causing lesions that can occur anywhere from the mouth to the anus and potentially leading to complications outside the digestive system. Its prevalence is steadily increasing in both adults and children, and individuals with the condition often present with a variety of symptoms, including persistent diarrhea, abdominal pain, rectal bleeding, fever, unintended weight loss, and chronic fatigue (Veauthier & Hornecker 2018), which collectively impact their overall quality of life. Treatment often involves medication to reduce inflammation and manage symptoms, as well as dietary changes and, in some cases, surgery for severe cases. A dietary approach is crucial to help manage symptoms and improve overall nutritional status. Interest in nutritional therapy for various diseases, including Crohn's disease, has grown, as dietary patterns are linked to the risk of developing the condition and can be modified to influence its progression, with preclinical evidence highlighting how dietary factors affect inflammation, intestinal barrier function, and the gut microbiome (Verburgt et al. 2021).

However, evidence on the practical application of different nutritional strategies in pediatric Crohn's disease, particularly in cases complicated by growth failure and refractory symptoms, remains limited. Reporting individual cases can therefore provide valuable clinical insight into how stepwise dietary interventions may be implemented in real-world settings, as well as their impact on disease outcomes and nutritional recovery. This case study will explore Mr. T, a 17-year-old Malay boy's clinical history, nutritional challenges, and the interventions that aimed to improve his nutritional status and overall well-being, emphasizing the impact of these measures in managing the disease and promoting recovery.

CASE REPORT

Written informed consent was obtained from the patient and legal guardian for the publication of this case report.

PATIENT'S HISTORY

Mr. T, a 17-year-old Malay boy, was admitted to Kuala Lumpur Women and Children Hospital for an Esophagogastroduodenoscopy (OGDS) and colonoscopy on 17/10/2024. He is a Form 5 student in the art stream but has not attended school for two months and is now attending the hospital school. A foster child raised by his maternal aunt since birth, Mr. T's biological mother, aged 35, has two children and no known medical issues. His foster mother, a 51-year-old housewife, has four children, while his 55-year-old foster father, a former lorry driver, has not worked for 10 years due to a pelvic fracture. The family's income comes from two elder sisters and social welfare.

Mr. T has refractory Crohn's disease, diagnosed in December 2018, complicated by a postoperative anastomotic leak, faltering growth, Southeast Asian ovalocytosis with iron deficiency anemia, morphine allergy causing rashes and chest pain, vitamin D insufficiency, and poor medication compliance. From the time of diagnosis, he showed progressive nutritional decline with recurrent weight loss and suboptimal height gain compared to age-appropriate growth expectations. Despite multiple nutritional interventions, including periods of enteral nutrition support and dietary counseling, his weight-for-age and BMI remained below the 3rd percentile, while his linear growth faltered, placing his height-for-age below the 10th percentile. Between 2018 and 2024, he experienced several relapses associated with reduced oral intake, micronutrient deficiencies, and poor adherence to prescribed nutritional regimens, which cumulatively worsened his growth trajectory. His treatment included Ferrous Fumarate 200 mg for iron deficiency, Ascorbic Acid 100 mg for vitamin C, Folic Acid 5 mg, and Thiamine 60 mg. Omeprazole 40 mg injection was used for peptic ulcers and reflux, and Prednisolone 5 mg was given to manage inflammation.

ANTHROPOMETRY

During the initial assessment conducted on 15/10/2024, the recorded weight was 31 kg and his best weight was recorded in February which was 38kg. Mr. T's height was measured at 158 cm that resulted in a Body Mass Index (BMI) of 12.4 kg/m2. By referring to the CDC Growth Charts, Mr. T's weight, height, and BMI are all below the 3rd percentile for his age and gender, indicating significant undernutrition (Figure 1). The ideal body weight (IBW) for his height is 53 kg, at the 50th percentile, these findings underscore the urgent need for targeted nutritional interventions to support Mr. T 's growth and overall nutritional status.

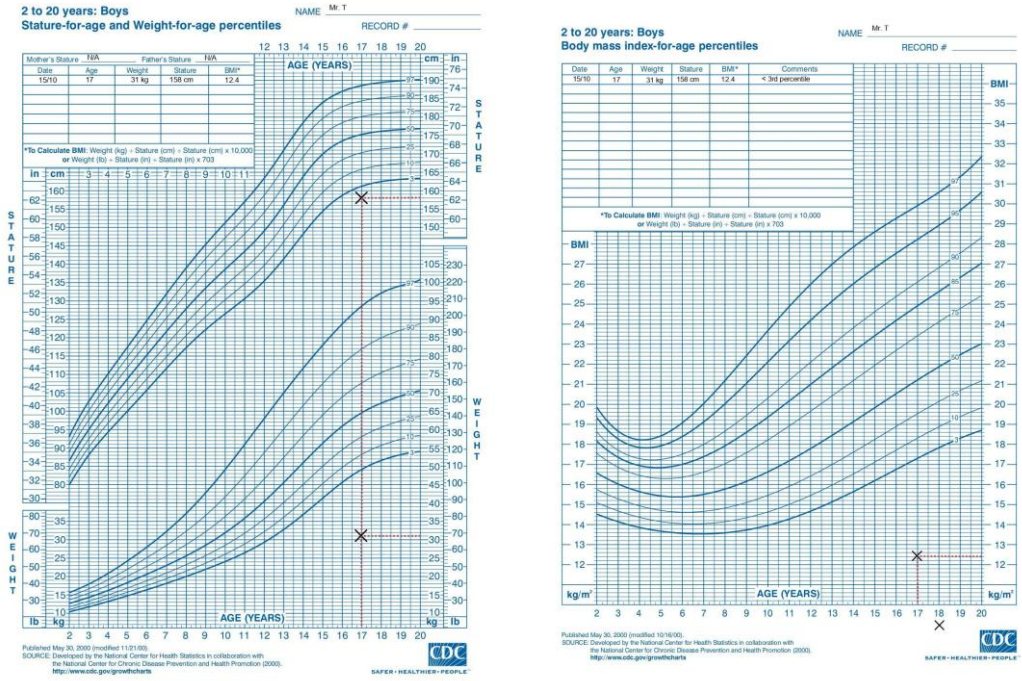

FIGURE 1 The Patient's Growth According to CDC Growth Chart

BIOCHEMICAL DATA

The latest laboratory results obtained on 15th October 2025 revealed several abnormalities relevant to Mr. T's nutritional and clinical status. He presented with hyponatremia (sodium 132 mmol/L), which may indicate fluid imbalance, and hyperkalemia (potassium 5.2 mmol/L), potentially related to dehydration, impaired renal excretion, or medication effects. His creatinine was notably low (31 µmol/L), reflecting reduced muscle mass likely due to chronic illness and undernutrition. Hemoglobin was decreased (11.4 g/dL), consistent with iron deficiency anemia, while serum albumin was also reduced (30 g/L), suggesting protein malnutrition and ongoing inflammation. Importantly, his C-reactive protein was markedly elevated (65.3 mg/L), confirming active inflammatory disease activity. These findings collectively demonstrate the nutritional challenges and active disease burden faced by the patient.

CLINICAL

Mr. T's vital signs were within normal limits, with a temperature of 36.5°C, blood pressure of 107/69 mmHg, and a heart rate of 124 bpm. Mr. T was able to ambulate independently and reported having bowel movements twice a day, with normal stool consistency.

DIETARY ASSESSMENT

Mr. T was on a normal oral diet in addition to nasogastric tube (NGT) feeding. He reported experiencing stomach aches for the past two months, which led to a reduced dietary intake. His estimated energy intake was approximately 1341 kcal/day with suboptimal oral intake. A summary of Mr. T's dietary intake is outlined below:

- Breakfast: 1 small bowl of cereal + 1 packet of full cream milk
- Lunch: Usually skipped due to poor appetite, occasionally only 1 glass of cocoa drink or plain water
- Dinner: 1 slice of bread or 2 tablespoons of rice + Oral Nutrition Support (via NGT): Standard formula, given 4 times per day

Previously, Mr. T was receiving oral nutrition support via NGT feeding at home. He had previously tolerated semi- elemental formula but was switched back to standard formula due to stock issues. During admission, he was able to take only small amounts of porridge orally while mainly relying on oral nutrition support.

At the last intervention, he was prescribed a new feeding regime (every 3 hours, 6 times/day). However, he only managed to trial the regime once after being kept NBM for OGDS. He reported stomach discomfort and loose stool (Bristol type 6), leading to a change back to his previous feeding regime.

TABLE 1 Laboratory Results of Mr. T

Test	Result	Normal Value	Indication
Electrolytes			
Sodium (mmol/L)	132 ↓	138-145	Low sodium could indicate dilutional hyponatremia due to fluid imbalance.
Potassium (mmol/L)	5.2 ↑	3.4-4.7	High potassium may suggest impaired renal excretion, dehydration or potentially influenced by medications.
Chloride (mmol/L)	101	98-107	Normal
Renal Function			
Urea (mmol/L)	3.0	2.60-7.50	Normal
Creatinine (umol/L)	31 ↓	55.0-96.0	Low creatinine may indicate reduced muscle mass which can be seen in patients with chronic disease or malnutrition.
Full Blood Count (FBC)			
Haemoglobin (g/dL)	11.4 ↓	13.5-18.0	Low hemoglobin suggests anemia, which is consistent with iron deficiency anemia.
Inflammatory Marker			
C- Reactive Protein (mg/L)	65.3 ↑	0.0-5.0	Elevated CRP indicates inflammation or infection, potentially related to the patient's chronic inflammatory condition (refractory Crohn’s disease).
Protein Status			
Albumin (g/L)	30 ↓	35.0-50.0	Low albumin levels may reflect protein malnutrition, poor nutritional status, or chronic inflammatory conditions, common in patients with Crohn’s disease.

NUTRITION DIAGNOSIS

[Resolved] Inadequate enteral nutrition infusion related to feeding optimization in progress as evidenced by current feeding regime only meets 68% of energy requirement.
[Active] Unintended weight loss related to reduced food intake due to stomach ache as evidenced by weight dropped by 7kg in 8 months time (18% of weight loss).

NUTRITION INTERVENTION

The goal of the intervention was to improve Mr. T’s nutritional intake by ensuring adequate calorie and protein intake. Mr. T's energy requirement was estimated at 2480 kcal per day, based on 80 kcal per kilogram of body weight, while his protein requirement was 77.5g per day, calculated at 2.5g per kilogram of body weight, as referenced from Dorothy E.M. Francis, Diet for Sick Children

(1987). The intervention involved switching Mr. T's nutrition from a standard formula to a semi-elemental product with 6 scoops mixed with 250 ml of water every 3 hours, 6 times per day, as he reported only being able to tolerate 250 ml per feeding. A semi-elemental formula is easier to digest and absorb, helping reduce gastrointestinal discomfort and ensuring adequate calorie and protein intake. It is especially suitable for patients with compromised digestion, such as those with conditions like Crohn's disease. This regimen provided an estimated 1692 kcal per day (meets 68% of estimated energy requirement) and 75.6 g of protein per day (meets 98% of estimated protein requirement). His feeding tolerance and weight progression would be closely monitored during the next follow-up.

A total of 10 dietetic follow-up sessions from 16th of October to 18th of November have been conducted for Mr. T to closely monitor his progress, assess his nutritional intake, and make necessary adjustments to his dietary plan to support his recovery and overall health. To summarize the follow-up sessions, Mr. T was initially on clear fluid on the first follow- up as for the preparation for an OGDS. On the next follow- up, he started with the planned feeding regime which was a semi elemental formula but reported experiencing stomach discomfort and loose stools (Type 6) , so it was switched to standard formula, which was better tolerated. The doctor then planned to begin exclusive enteral feeding (EEN) and the plan included gradually increasing the dilution, beginning with 7 scoops and gradually increasing to 8 and then 9 scoops every 4 hours with the same volume of water, 250 ml/ feeding. The final regime provided a total of 2360 kcal/ day (meets 94% of estimated energy requirement) and 94.5 g protein/ day (achieves 100% of estimated protein requirement). After he showed improvement with normal stools and no stomach pain, he remained on EEN and the next step was to start the Crohn's Disease Exclusion Diet (CDED), with Mr. T and his mother were educated about it and were given handouts. The CDED diet was ordered for Mr. T in the hospital, noting that only olive oil can be used in cooking and no flour is allowed in the diet. The detailed menu of CDED diet in the hospital was summarized as below:

- Breakfast: Chicken porridge + 1 piece of potato
- Lunch: Rice + Chicken soup + 1 piece of potato + Vegetables (Carrot/ Spinach/ Cucumber/ Tomato) + 1 whole apple
- Dinner: Rice + 2 whole egg (Fried/ full boiled) + Vegetables (Carrot/ Spinach/ Cucumber/ Tomato) + 2 pieces of banana

Mr. T continued with ONS, 9 scoops of standard formula + 250ml of water, three times a day to provide 1180 kcal/ day (48% of estimated energy requirement) and 47.3 g protein/ day (61% of estimated protein requirement). In CDED phase 1, oral nutrition support needs to provide 50% of energy requirement and will then be reduced in phase 2 and phase 3. Initially, Mr. T struggled to finish his meals, but he was encouraged to complete them and as he adapted, he was able to eat well, and the plan was maintained. Education on using Modulife, a comprehensive patient platform that simplifies following the CDED by providing 24/7 expert support and user-friendly tools that offers exclusive features such as tracking tools, tailored recipes and meal plans, unlimited messaging with experts, and on-demand educational resources to enhance patient guidance and support was also provided to Mr. T and his caregiver.

The plan continued during follow-up visits, focusing on supporting adherence to the CDED diet and ONS with some recommendations given to increase his acceptance towards ONS such as trying with other flavours (matcha/ coffee/ wheat/ almond). During the last follow-ups, Mr. T demonstrated full adherence to the CDED diet, and his understanding of the diet, along with that of his caregiver, was confirmed. In summary, the treatment plan shifted to exclusive enteral feeding (EEN) starting with a low dilution and gradually increasing to higher amounts to ensure adequate calorie and protein intake. This step-up approach allowed Mr. T to adjust and reach nutritional goals.

Once he stabilized, he transitioned to the CDED diet, initially struggling to complete meals. However, with encouragement and dietary adjustments, he showed improvement in his intake and overall adherence.

OUTCOME

The outcome for the anthropometry part showed positive signs where Mr. T's weight improved progressively from 31.9 kg at the initial review to 35.3 kg at the last follow-up, reflecting a total weight gain of 3.4 kg in about one month. This weight improvement aligns with the implementation of nutritional interventions, including the introduction of exclusive enteral nutrition (EEN) and gradual incorporation of the Crohn's Disease Exclusion Diet (CDED), which ensured adequate calorie and protein intake. These strategies likely contributed to better nutritional status and weight restoration. Thus, the previous nutrition diagnosis, unintended weight loss was resolved.

On the other hand, the patient's biochemical results after follow-up on 15/10 and 28/10 showed notable improvements. For electrolytes, sodium increased from 132 mmol/L to 140 mmol/L, moving into the normal range (138–145 mmol/L), indicating improvement. Potassium decreased from 5.2 mmol/L (above normal) to 4.3 mmol/L, which is

within the normal range (3.4–4.7 mmol/L), also reflecting improvement. Chloride remained stable and within the normal range, measured at 101 mmol/L and 103 mmol/L (normal: 98–107 mmol/L). Regarding renal function, urea levels increased slightly from 3.0 mmol/L to 4.8 mmol/L, remaining within the normal range (2.6–7.5 mmol/L). Creatinine remained consistently low at 31 µmol/L, below the normal range (55–96 µmol/L). Low creatinine may indicate reduced muscle mass, which can be associated with chronic disease or malnutrition. Moreover, for the full blood count (FBC), hemoglobin showed a slight increase from 11.4 g/dL to 11.6 g/dL, though still below the normal range (13.5–18.0 g/dL). This suggests persistent anemia, likely related to iron deficiency, despite some improvement. The inflammatory marker, C-reactive protein (CRP), demonstrated a significant decrease from 65.3 mg/L to 5.6 mg/L. Although still slightly elevated compared to the normal reference (0–5 mg/L), this result indicates substantial improvement in inflammation, likely related to the patient's refractory Crohn's disease. Last but not least, the albumin improved from 30 g/L to 33 g/L, but remained below the normal range (35–50 g/L). Persistently low albumin may reflect protein malnutrition, poor nutritional status, or ongoing inflammation, which is commonly seen in patients with Crohn's disease.

Figure 2.0 shows a line graph illustrating the patient's biochemical progression from 15th October to 28th October 2025. In addition, overall, from the first follow-up to the latest summary of clinical data, Mr. T's clinical status showed improvements in vital signs, with temperature remaining stable, blood pressure within a consistent range of 92/54 to 118/72 mmHg, and heart rate

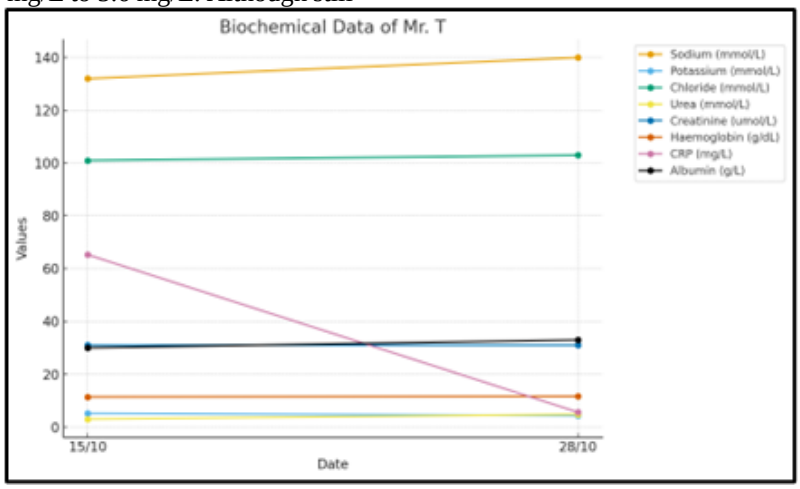

FIGURE 2 Line Graph of The Patient's Biochemical Progression

FIGURE 3 Mandatory and Allowed Foods in CDED: Phase

FIGURE 4 Disallowed Foods in CDED: Phase 1

stabilizing between 88–119 bpm. Bowel output also improved from 1-2 times daily with Bristol type 6 to normal stool, type 4, indicating better gastrointestinal function.

DISCUSSION

The use of exclusive enteral nutrition (EEN) as an effective treatment for Crohn's disease (CD) has been well-documented over the past 20 years, involving a nutritionally complete liquid diet replacing solid and other fluids (except water) and serving as the primary induction therapy for remission in newly diagnosed children and adolescents with CD in New Zealand and other countries, typically administered for 8 weeks with gradual volume increase over the first 3 to 4 days based on tolerance and side effects, followed by a slow reintroduction of foods after the treatment period (Adamji & Day 2019). Multiple studies have demonstrated that exclusive enteral nutrition (EEN) is both effective and safe for inducing remission in children with luminal Crohn's disease, leading to its widespread use as the primary treatment after diagnosis. This is also evident in Mr. T's previous treatment when the doctor recommended starting exclusive enteral nutrition (EEN) as part of his management plan, and we can see that Mr. T was able to achieve his nutritional requirements with the planned regime of oral nutritional supplements (ONS).

The European Society for Parenteral and Enteral Nutrition (ESPEN) guidelines suggest that another dietary management, which is the Crohn's Disease Exclusion Diet (CDED) can be considered a potential alternative to EEN for both pediatric and adult patients. The CDED is a three-phase dietary plan starting with a highly restrictive Phase 1 (weeks 0–6) that eliminates potential triggers while emphasizing high-quality proteins and microbiome-supporting ingredients, followed by a more flexible Phase 2 (weeks 6–12) where restricted foods are gradually reintroduced, and concluding with Phase 3 from week 13 onward for at least nine months, transitioning to a personalized and sustainable dietary approach to enhance long-term adherence (Sigall Boneh et al. 2024). Each phase of the CDED diet includes specific mandatory foods to support gut health and nutritional needs. According to ModuLife, in Phase 1, high-quality protein sources like chicken, eggs, along with carbohydrates- rich food such as potatoes and rice with fruits such as bananas and apples, are essential. This structured approach is why we can see that in Mr. T's planned menu, there is a careful selection of these mandatory foods to support his condition and overall well-being. The figures below show phase one of the CDED diet, which Mr. T was following upon review.

Phase 2 introduces additional options for each food group including fish, oat, whole wheat bread, chickpeas and a wider range of fruits and vegetables. Phase 3, maintenance phase, emphasizes a balanced diet with a mix of these foods tailored to the patient's tolerance and nutritional needs. There is no food that is mandatory in the third phase, but foods that have the potential to cause harm should be controlled or avoided. The dietitian plays an important role in the Crohn's Disease Exclusion Diet (CDED) by designing personalized meal plans, educating patients on food triggers, and monitoring nutritional intake to help manage symptoms and improve overall health. Previous studies have demonstrated that the CDED can induce remission and reduce

objective inflammation markers in pediatric patients (Fliss-Isakov et al. 2023).

CONCLUSION

In conclusion, the use of exclusive enteral nutrition (EEN) and the Crohn's Disease Exclusion Diet (CDED) have shown significant improvements in Mr. T's overall nutritional status. These dietary approaches, combined with careful monitoring and adherence to nutritional guidelines, were key in improving his health and quality of life, aligning with current best practices for managing pediatric Crohn's disease. Key points of learning from this case include the essential role dietitians play in creating, implementing, and adjusting effective dietary plans tailored to individual needs, the importance of patient education and ongoing support in maintaining adherence, and the benefits of a clear, structured approach when managing complex conditions like Crohn's disease. This case study also emphasizes that when nutritional strategies are thoughtfully planned and consistently followed, significant improvements in health, symptoms, and overall well-being can be achieved, showcasing the potential for positive outcomes through targeted, evidence-based dietary interventions.

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