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DIETARY FIBER IN MANAGING CONSTIPATION IN MAJOR BURN TRAUMA PATIENTS: A CASE SERIES REPORT

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Abstract

Burn injuries result in tissue damage due to exposure to thermal sources or extreme cold. Following burn trauma, systemic inflammatory responses can impair gastrointestinal (GI) function, often leading to constipation. While dietary fiber supplementation is commonly recommended to prevent constipation in the general population due to its ability to enhance intestinal motility, there is limited literature regarding its role in managing constipation among patients with major burn injuries. This case series presents two patients admitted with 34% and 35% total body surface area (TBSA) burns, respectively. Both patients experienced delayed defecation during the first week of hospitalization, without experiencing hypovolemic shock, and had not been administered any sedative agents or vasopressors. Their average dietary fiber intake were 11.1 g and 6.5 g, respectively. One male patient, who was diagnosed with diabetes mellitus (DM), continued to experience constipation until the second week, which improved following dietary modification to a DM-specific regimen. Meanwhile, the female patient showed an improvement in bowel movements in the second week, despite her low fiber intake.

keywords : *dietary fiber, constipation, defecation, major burns*

Introduction

Burn injuries involve tissue damage or loss resulting from exposure to thermal sources, including flames, hot oils or water, radiation, electricity, or extreme cold.[1] In 2019, approximately 8.3 million individuals globally were affected by burn incidents, with the highest prevalence found among adolescents aged 10 to 19 years.[2] At Dr. Cipto Mangunkusumo General National Hospital (RSCM), the adult population most frequently affected by burns consists of laborers, with flames being the primary cause. Among these cases, 73,9% presented with third-degree burns and 41,9% had burn coverage affecting 11 to 30% of the total body surface area (TBSA).[3]

Following burn trauma, systemic inflammatory responses can impair gastrointestinal (GI) function, with one common manifestation being constipation. Approximately 36,1% of burn patients with injuries exceeding 20% TBSA experience delayed defecation, defined as having no

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bowel movement within six days of admission.[4] This delay can be attributed to various factors, including shock-induced splanchnic hypoperfusion, electrolyte imbalances, and administration of sedatives or vasopressors, all of which can reduce intestinal motility.[5,6]

Delayed defecation is significantly associated with increased risks of enteral feeding intolerance, persistent constipation despite laxative therapy, and a greater likelihood of requiring total parenteral nutrition (TPN) compared to patients who experience early defecation in critical care settings.[7] Furthermore, fecal accumulation resulting from constipation can promote pathogenic bacterial overgrowth in the GI tract, potentially leading to bacterial translocation and systemic infections in burn patients, particularly given the pre-existing increase in intestinal epithelial permeability.[5,6]

Dietary fiber supplementation is commonly recommended to prevent constipation in the general population due to its ability to enhance intestinal motility.[8,9] However, studies have shown inconclusive results regarding the impact, safety, tolerability and efficacy of dietary fiber supplementation in managing constipation in major burn trauma patients.[10-12] This case series aims to review the dietary fiber intake in managing constipation for patients with major burn.

Case Series

We gathered data on 2 cases of acute burn injury with 20–30% TBSA admitted to the Burn High Care Unit (HCU) at Dr. Cipto Mangunkusumo General National Hospital (RSCM) between February and March 2025. The demographic and clinical data were retrospectively collected (Table 1). This report comprised of one female and one male patient, both of whom had normal nutritional status based on body mass index (BMI).

During hospitalization, the mean energy intake was 26 kcal/kg of body weight (BW) in Case 1 and 27 kcal/kg BW in Case 2. Both patients received a combination of solid and liquid oral nutrition therapy. Neither had a documented history of drug or food allergies.

Case 1

A 19-year-old female was admitted to Burn High Care Unit (HCU) with primary complaints of burns covering 34% TBSA and involving the face, neck, torso, and bilateral upper and lower extremities sustained 12 hours prior to admission. Injuries resulting from flames secondary to explosion of portable stoves in an open environment. During the acute phase, she was successfully resuscitated and showed no signs of unstable hemodynamics.

Physical examination revealed a critically ill patient who remained alert and oriented, with a body weight of 47.5 kg, height of 159 cm, and normoweight

nutritional status. During ICU treatment, Patient 1 received oral diet consisted of a combination of soft food and oral nutritional supplement (ONS).

During the first week of hospitalization, the patient's fiber intake was notably low, with an average of 4.5 g over 7 days. For the first six days, she received a prescribed nutritional therapy of 1350 kcal comprising 900 kcal strained porridge and 150 mL of high-protein ONS administered three times daily. The porridge contained carbohydrates (e.g., rice congee or oatmeal with palm sugar and coconut milk broth), one egg per meal, and one fruit serving at lunch and dinner. Consequently, carbohydrates and fruit were the only sources of dietary fiber. This oral nutrition regimen contains 4.8-g fiber, which is still below the recommended daily dietary fiber intake.

By day 7, her dietary intake had increased to a regular diet of 1100 kcal alongside 200 mL of high-protein ONS three times daily. Due to the patient's habitual preference for non-rice carbohydrate sources, her meals consisted of potatoes or bread, one serving each of animal and plant-based proteins, one serving of vegetable, and one serving of fruit. The highest fiber intake was observed on day nine (10.8 g), coinciding with the consumption of 1.5 servings of potatoes, three servings of vegetables, and three servings of fruits.

The patient experienced delayed defecation during the first week, with the first defecation occurring on day seven. Later, the bowel patterns normalized with no constipation, maintaining a frequency of every 2-3 days and smooth-to-solid fecal consistency. No vasopressors or sedatives were administered. The patient was successfully resuscitated and showed no signs of shock during the acute phase.

Case 2

A 35-year-old male was admitted to Burn High Care Unit (HCU) with primary complaints of burns covering 35% total body surface area (TBSA) and involving the face, torso, and bilateral upper and lower extremities sustained 10 h prior to admission. The injury mechanism was attributed to a diesel tank explosion during a marine fuel refilling operation. During the acute phase, he was successfully resuscitated and showed no signs of unstable hemodynamics.

Physical examination revealed a critically ill patient who remained alert and oriented with a body weight of 59.1 kg, height of 167 cm, and normoweight nutritional status.

Patient 2 received oral diet consisted of a combination of solid diet and ONS. The

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patient's fiber intake fluctuated proportionally with energy consumption, averaging 11.1 g over 19 days of hospitalization. The patient received a standard diet and high-protein ONS during the first 11 treatment days.

On day 11, Patient 2 had decreased consciousness and hyperglycemia was detected, with a laboratory examination showing a blood glucose level of 295 mg/dL, hemoglobin A1C (HbA1c) of 10,8%, and blood gas analysis pH of 7.38, leading to a diagnosis of diabetic ketoacidosis (DKA) on day twelve. NGT insertion was initiated and nutrition therapy was switched from solid to liquid diet.

Clinical management included initiating the insulin infusion protocol and monitoring blood glucose curve daily. The patient's diet was also adjusted to a DM-specific diet and hospital-prepared DM-specific liquid diet. The DM diet differed from the standard diet in that it incorporated an additional serving of vegetables in each meal to increase fiber intake. To improve glycemic control in patients with DM, the hospital-prepared DM-specific liquid diet was fortified with 3 g of inulin and 7 g of olive oil.

Delayed defecation occurred during the first week of the study, with the first defecation occurring on the eighth day of the study. Constipation persisted into the second week and was characterized by two defecation episodes in seven days. In the third week, the bowel frequency improved to four episodes per week, which coincided with improved dietary fiber intake. The highest fiber intake was observed on days 18 and 19 (14.8 g). No laxative agents were administered during hospitalization.

Tables and Figures

Table 1. Demographic and patients' clinical characteristics

	Case 1	**Case 2**
Age (years old)	19	35
Sex	Female	Male
Anthropometric status		
Body weight (kg)	47,5	59,1
Body height (cm)	159	167
BMI (kg/m^2)	18,8	21,2
BMI Interpretation	Normoweight	Normoweight
Total body surface area (TBSA)	34%	35%
Mean food intake during hospitalization		
Energy	1170 kcal (26 kcal/kgBW)	1600 kcal (27 kcal/kgBW)
Dietary fiber	6,5 g	11,1 g
Constipation during hospitalization	Yes	Yes
The use of laxative agents during treatment period	No.	No

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Figure 1. Energy intake during hospitalization period

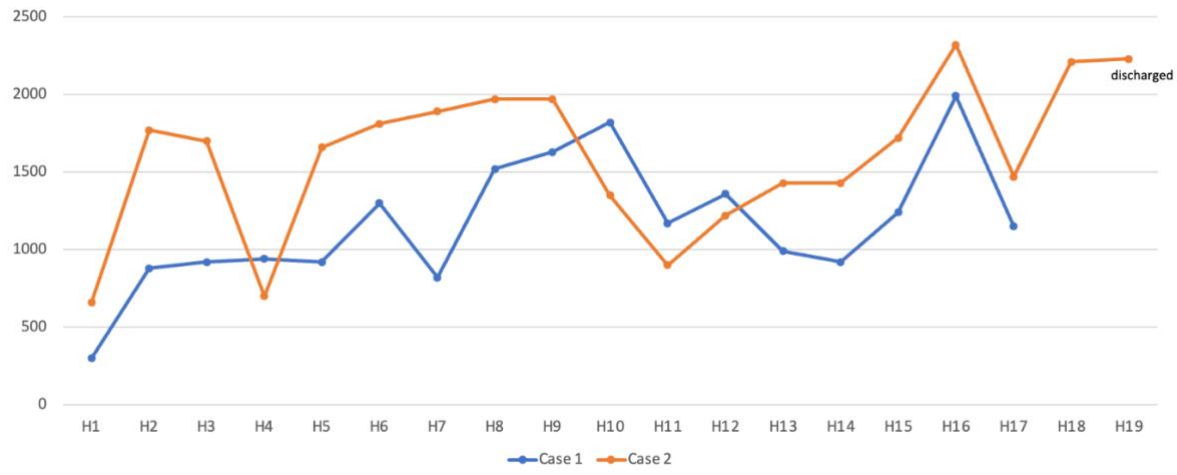
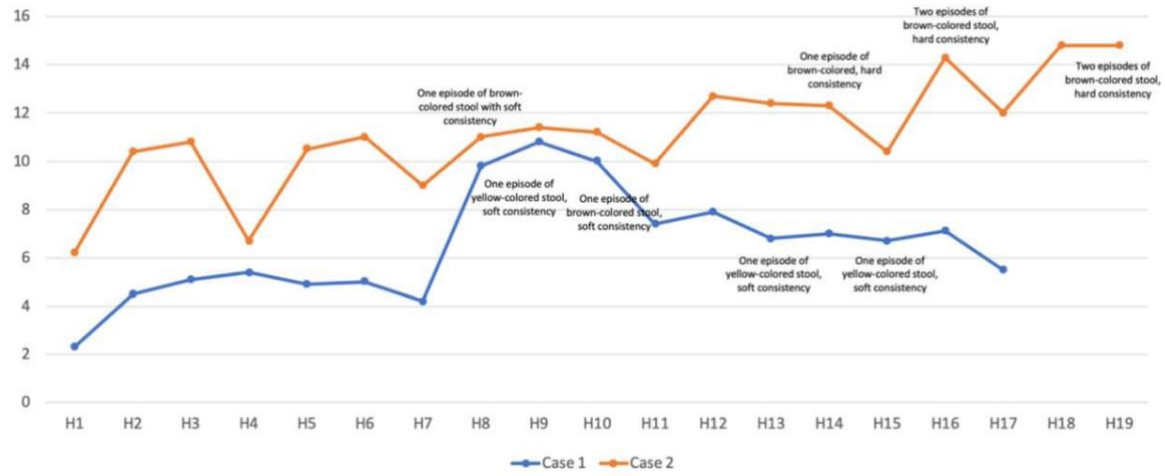


Figure 2. Dietary fiber intake during hospitalization period



Discussion

Constipation is defined by the American Gastroenterology Association as bowel movement frequency of 3 times a week, incomplete evacuation sensations, hard stool consistency, straining during defecation, or the need for manual maneuvers to facilitate rectal emptying.[13] However, several of these criteria are relatively subjective and challenging to apply to critically ill patients with non-ambulatory functional capacity or bedridden status.[14] Consequently, clinical studies in critically ill patients often rely on quantifiable metrics such as defecation frequency during hospitalization or time to first defecation

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after admission. Nassar et al. defined constipation as the absence of bowel movements within the first 4 days of hospitalization, whereas Trexler et al. extended this to six days post-admission. Christensen et al. established a consensus definition for ICU settings, categorizing constipation as the absence of bowel movements within the first 72 h of admission.[7,15,16]

Both patients exhibited delayed defecation during the first week of hospitalization, with the first bowel movement occurring on day eight. This finding aligns with previous observational studies reporting a high incidence of constipation in critically ill populations, ranging from 5% to 83%. GI complications, such as constipation, delayed gastric emptying, bacterial translocation, and sepsis, are frequently documented in patients with second- and third-degree burns involving >20% of the total body surface area (TBSA).[16]

The delayed defecation observed in both patients during the first week may be attributed to ongoing resuscitation. Acute burn trauma requires aggressive fluid resuscitation, which may unintentionally cause gastrointestinal edema. Such edema reduces GI contractility and prolongs intestinal transit time, thereby worsening motility dysfunction.[16]

Patient 1 had improved bowel patterns by the second week, with three episodes of defecation per week without laxative intervention. This patient was successfully resuscitated, showed no signs of shock, and did not require vasopressor or sedative agents during hospitalization. The patient was prescribed with a nutritional regimen that included 4.8 g of dietary fiber. This amount remains below the daily recommended intake according to the Ministry of Health Regulation No. 28 of 2019, which specifies a daily fiber intake of 32 g for individuals aged 19-29 years.[19] The diet was tailored to align with the patient's preference and limited intake capacity during the initial week of hospitalization, where substantial food consumption was not feasible; hence, fiber sources were limited to strained porridge and fruit.

Patient 1 had a mean fiber intake of 6.5 g, with the highest fiber consumption of 10.8 g on day 9. During the first week, fiber consumption was notably low, averaging 4.5 g over seven days. For the first six days, the patient was prescribed with a nutrition therapy consisting of strained porridge and high-protein ONS. The strained porridge provided fiber solely from carbohydrate sources (e.g., rice congee, oatmeal) and fruit, while minimal additional fiber (0.6 g/day) was derived from tempeh—a fermented soybean product—as one of the ingredients in the ONS. Tempeh contained

approximately 5,4 grams of fiber per 100 grams.[14] Delayed defecation was observed during the first week; however, by day eight, the patient's bowel patterns improved with an increase in fiber intake. Constipation did not recur in the following days despite a decline in fiber consumption.

Dietary challenges observed in Patient 1 included an emerging sense of boredom with the hospital-provided menu starting from the 11th day of hospitalization, during which the patient consumed only the side dishes, fruits, and snacks while neglecting other meal components. The patient expressed a wish to consume food from external sources; however, the standard operating procedures of the ULB HCU prohibit the consumption of external food items. This observation aligns with the findings of Rathnayake et al., who noted that patient preferences often shift away from hospital-provided meals toward externally sourced alternatives, particularly home-cooked foods, as the duration of hospitalization increases.[20]

Patient 2 continued to have constipation in the second week with bowel movements twice a week. On day 11, Patient 2 developed hyperglycemia with a blood glucose level of 295 mg/dL and was diagnosed with DM based on an HbA1c value of 10.8%. This aligns with an observational study by Sangnes et al., which found that patients with DM, regardless of constipation status, exhibited prolonged colon transit times compared to healthy populations (p=0.01). The pathophysiology of DM-related gastrointestinal dysfunction is multifactorial, involving neuropathic injury, alterations in the autonomic nervous system, enteric nervous system, and interstitial cells of Cajal (ICC), as well as direct myopathic changes in smooth muscle. Diabetic neuropathy may affect the entire gastrointestinal tract, including the colon.[21]

On day 11, following a diagnosis of diabetic ketoacidosis and decreased consciousness, Patient 2 underwent nasogastric tube (NGT) placement. Enteral nutrition via nasogastric tube (NGT) was indicated due to preserved gastrointestinal function alongside impaired consciousness, which elevated aspiration risks associated with oral intake and anticipated inadequacy in meeting caloric requirements.[23]

The nutritional therapy of Patient 2 was adjusted to a DM-specific solid diet and a hospital-prepared liquid diet. Following this dietary modification, the fiber intake of Patient 2 peaked at 14.8 g on days 18 and 19, which was correlated with improved defecation frequency during the third week (4 bowel movements/week). These findings are consistent with those of experimental studies demonstrating that fiber supplementation in enteral nutrition reduces the incidence of

constipation in critically ill patients (RR 0.33, 95% CI 0.19–0.58, p 0.0001).[22] A meta-analysis by Liu et al. further highlighted that fiber supplementation not only reduced constipation (OR 0.21, 95% CI 0.09–0.47, p <0.001) but also shortened the time to full enteral feeding (p <0.05), ICU stay (p <0.001), and overall hospitalization (p <0.001).[9]

Patient 2's mean daily fiber intake was 9.8 g from days 1 to 11, rising to 13 g after initiating the DM diet (days 11–19). The DM protocol at RSCM Hospital comprised a standard diet with added plant-based protein (1 exchange portion at breakfast) and vegetables (1 exchange portion per main meal), supplemented with inulin fiber to enhance glycemic control and defecation patterns. Inulin, a soluble fiber, improves stool consistency by increasing the Bristol Stool Scale scores by 0.29 (p=0.008), although its effects on constipation in critically ill patients remain underexplored.[24]

Patient 2 exhibited delayed defecation in week 1, constipation in week 2, and improved bowel frequency (4 times/week) in week 3, coinciding with dietary adjustments. The patient was discharged after 19 days of hospitalization.

Inulin is a type of soluble fiber and has been associated with improvement in blood glucose control through its gut fermentability and viscosity. It also stimulates the secretion of gut-derived hormones such as glucagon-like peptide-1 (GLP-1), cholecystokinin and peptide YY which slows down gastric emptying and glucose absorption in the intestine.[25]

Furthermore, a randomized controlled trial by Park demonstrated that 16 g/day of inulin supplementation for 7 days did not affect gut microbiome diversity in intensive care unit (ICU) patients.[11] However, another study by Peng showed that 15 g/day of inulin supplementation for 10 days significantly improved constipation in ICU patients.[12] Both studies did enteral administration of fiber supplementation, either by nasogastric or orogastric tube, and did not report any adverse effects or poor tolerance of enteral dietary fiber administration.[11,12]

This highlighted the safety and tolerability of enteral dietary fiber supplementation. A meta-analysis by Liu et al showed that enteral dietary fiber administration significantly decreased the risk of gastrointestinal intolerance such as vomiting, diarrhea, regurgitation and constipation. It also decreased the time needed to reach full enteral nutritioin, ICU stay duration and hospital stay.[9]

Observational studies have demonstrated that constipation adversely affects critically ill populations. Gacouin et al. reported prolonged ICU stays, mechanical

ventilation duration, and central venous catheter use in patients with delayed defecation (>6 days post-admission) compared with those with early defecation (≤6 days). The delayed group also had higher infection rates than the control group (66% vs. 34%, p <0.01).[26]

Dietary fiber plays a critical role in gastrointestinal health by modulating nutrient digestion and absorption, enhancing stool frequency and consistency, and promoting gut microbiota diversity and short-chain fatty acid (SCFA) production. SCFAs improve colonic blood flow, reduce luminal pH, support epithelial cell proliferation, enhance immunomodulation, and suppress pathogenic bacteria.[27]

Inoue et al showed that high-fiber diet (8,2 g/day of total fiber) was significantly associated with SCFA-associated genera of gut microbiomes such as *Anaerostipes, Bifidobacterium* and *Fusicatenibacter*. It also further noticed that increase of healthy gut microbiome also correlated with improvement in bowel-related quality of life.[28] This was supported by other study which showed that beneficial gut microbiota are significantly protective against constipation.[29]

Increasing consumption of fiber can improve constipation. Mechanically, fiber with larger, coarser particle sizes enable physical interaction with the mucosa and promotes the secretion of water and mucus, formation of bulky and soft stools that are easily secreted.[30]

Both soluble (e.g., psyllium) and insoluble (e.g., coarse wheat bran) fibers improve stool consistency. Soluble fibers retain water, forming viscoelastic gels to soften stools, whereas insoluble fibers mechanically stimulate intestinal peristaltics.[30] The benefits of dietary fiber in critical care have been demonstrated in experimental studies. Caparros et al. found that 8.9 g/L of fiber in liquid diets reduced constipation (p <0.005) and urosepsis (p <0.001) compared with controls.[31]

The American Society for Parenteral and Enteral Nutrition recommends soluble fibers, such as fructooligosaccharides (FOS) or inulin (10–20 g/day in divided doses), for hemodynamically stable critically ill patients with diarrhea. However, fiber is contraindicated in high-risk patients (e.g., mesenteric ischemia, dysmotility) due to potential gastrointestinal obstruction, particularly post-surgery or trauma.[32]

Both patients in this report had dietary fiber intake lower than ESPEN recommendations for patients receiving EN, which is 15–30 g/day. However, there has been no clear recommendations specifically for critically ill patients receiving EN therapy.[33]

Conclusions and Recommendation

The constipation observed in Patient 2 was likely attributable to hyperglycemia, and the newly diagnosed DM was identified on the eleventh day of hospitalization. Consequently, improvements in bowel patterns were only observed during the third week following glycemic control through pharmacotherapy and dietary modifications with a fiber-supplemented DM-specific liquid diet. Constipation in Patient 1 resolved despite low fiber intake. This case series did not demonstrate improvement in constipation following fiber intake in patients with major burns.

A notable limitation of this case series is the absence of targeted high-fiber interventions, as data collection was restricted to observational monitoring of daily fiber intake and defecation patterns across individual patients. Nevertheless, the resolution of constipation in Patient 2 following increased fiber consumption warrants consideration of systematic high-fiber dietary protocols for patients with burn injury in general, particularly given the elevated prevalence of constipation within this clinical population.

This case series result warrants for further research regarding a standard and measurable dose of dietary fiber that may be beneficial to improve signs and symptoms of constipation specifically in major burn trauma patients.

Competing Interest

The authors declare that there are no competing interests related to the study

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