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BURNS

Case Report

DIETARY SOLUBLE FIBER IMPROVED FECAL CONSISTENCY IN BURNED PATIENTS WITH DIARRHEA

Evania Astella Setiawan[1*)], Aditya Wardhana[2], Wina Sinaga[1], Ayu Diandra Sari[1], Metta Satyani[1], & Lily & Indriani Octovia[1]

1. *Department of Nutrition, Dr. Cipto Mangunkusumo Hospital, Faculty of Medicine Universitas Indonesia, Jakarta, Indonesia*
2. *Burn Unit, Division of Plastic Surgery, Dr. Cipto Mangunkusumo Hospital, Faculty of Medicine Universitas Indonesia, Jakarta, Indonesia.*

ABSTRACT

Backgrounds: Diarrhea frequently occurs in severely burned patients attributable to impaired intestinal integrity and dysbiosis. Soluble fiber may improve intestinal barrier function, avoid bacterial translocation, then subsequently prevent and treat diarrhea. Soluble fiber is rapidly fermented by commensal bacteria and produces short-chain fatty acids (SCFA).
Case Reports: A 51-year-old male with severe burn injury involving 53,5% total body surface area (TBSA) and diarrhea were given soluble fiber as part of his diet.
Results: Administration of 6–10 g/d soluble fiber clinically improves stool consistency, assessed by Bristol Stool Scale, in the severely burned patient. The patient was discharged after 19 days of hospitalization with improvement in clinical condition.
Summary: SCFA maintains intestinal integrity, supports the growth of commensal bacteria, and inhibits pathogens. There is no specific recommendation regarding fiber intake in burned patients
***Keywords**: Burns; Dietary fiber; Nutrition therapy; Case report*

ABSTRAK

Latar Belakang: Diare sering terjadi pada pasien dengan luka bakar berat yang disebabkan oleh gangguan integritas usus dan disbiosis. Serat larut dapat meningkatkan fungsi barier usus, menghambat translokasi bakteri, yang kemudian akan mencegah dan mengobati diare. Serat larut dengan cepat difermentasi oleh bakteri komensal dan menghasilkan asam lemak rantai pendek.
Laporan Kasus: Seorang laki-laki 51 tahun dengan luka bakar berat yang melibatkan 53,5% total luas permukaan tubuh (TBSA) dengan diare dan diberikan serat larut sebagai bagian dari dietnya.
Hasil: Pemberian serat larut 6-10 g/hari secara klinis memperbaiki konsistensi feses, yang dinilai dengan Bristol Stool Scale, pada pasien luka bakar berat. Pasien dipulangkan setelah 19 hari rawat inap dengan perbaikan kondisi klinis.
Ringkasan: Asam lemak rantai pendek mempertahankan integritas usus, mendukung pertumbuhan bakteri komensal, dan menghambat patogen. Belum ada rekomendasi khusus mengenai asupan serat pada pasien luka bakar.
***Kata Kunci:** Luka bakar; Serat makanan; Terapi nutrisi; Laporan kasus*

Conflicts of Interest Statement:
The Author (s) listed in this manuscript declare the absence of any conflict of interest on the subject matter or materials discussed.

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BACKGROUNDS

A descriptive analysis study showed the leading cause of mortality in burned patients was sepsis (42.1%), with a mortality rate of 34%, in Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia.[1,2] Severe burns cause systemic ischemia and tissue hypoperfusion. These contribute to dysbiosis and the damage of intestinal integrity, which allows for bacterial translocation and ultimately the risk of sepsis.[3] Diarrhea is a frequent manifestation of this condition and subsequently increases mortality as it causes dehydration, electrolyte disturbances, impaired absorption of nutrients, and exacerbates the risk of malnutrition.[4]

Modulation of the intestinal microbiota through soluble fiber intakes improve diarrhea. SCFA is produced from the fermentation of soluble fiber by commensal bacteria. SCFA preserves intestinal integrity as it lowers the luminal pH, supports the growth of commensal bacteria, inhibits pathogens, and fulfills 60–70% of the energy needs of colonocytes.[5] Despite its beneficial effects, soluble fiber intake in critically ill patients is often inadequate. Thus far, there are no specific recommendations regarding the administration of soluble fiber in patients with severe burns.[6]

CASE REPORT

The fifty-one-year-old male suffered superficial burns of up to a full-thickness of 53.5% TBSA due to flames. The patient is vigilant and hemodynamically stable. The patient had diarrhea on the 3rd day of hospitalization. Diarrhea was four times a day with liquid consistency and a little solid piece. The soluble fiber intake was analyzed from the actual diet consumed by the patient during hospitalization, including oral nutrition support (ONS), ranging 2–10 g/d. The intake profile during hospitalization is shown in Table 1. The mean intake of soluble fiber was 6.1 ± 2.4 g/d. While monitoring diarrhea, fecal consistency was observed using the Bristol Stool Scale, and the median value was 4 (7–3).

The patient was provided a menu with additional soluble fiber from dietary food sources, such as bananas, oranges, and carrots, as well as oral nutritional support (ONS) formula containing inulin in addition to lactose-free ONS containing high protein.

RESULTS

Diarrhea resolved after the 7th day of hospitalization, with the Bristol Stool Scale 7 reduced to 5.

Table 1. Patients Characteristics

Variables	Value
Energy (kcal/day) †	1630 ± 499
Protein (g/day) †	74 ± 27,8
Fat (g/day) †	45,4 ± 12,2
Carbohydrate (g/day) †	228,4 ± 83
Soluble fiber (g/day) †	6,1 ± 2,4
Bristol Stool Scale ‡	4 (3-7)

† mean ± standard deviation all such values
‡ median (minimum-maximum)

On the stratification of diarrhea status (Table 2), the analysis showed a difference in the mean intake of soluble fiber, which tends to be significant during diarrhea compared to non-diarrhea. During diarrhea, the mean intake of soluble fiber was 3.66 ± 1.97 g/d, which was less than in normal conditions, with a mean intake of 6.61 ± 2.45 g/d (P = .051).

Table 2. Comparison of Mean Soluble Fiber Intake in Diarrhea and Non-Diarrhea

	Non-Diarrhea † n = 10	Diarrhea ‡ n = 4	*p*-value
Soluble fiber intake §	6.61 ± 2.45	3.66 ± 1.97	0.051

† *Bristol Stool Scale* 3–5; ‡ *Bristol Stool Scale* 6–7; § analysis between groups, two-tailed independent *t*-test analysis.

After controlling for confounding factors, the multivariate analysis was carried out to evaluate the relationship between soluble fiber intake and the Bristol Stool Scale (Table 3). Confounding factors included were the provision of lactose-free formulas, energy intake, and administration of antibiotics to the patient.

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Table 3. Generalized linear model for Soluble Fiber Intake on Bristol Stool Scale

Variables	Adjusted difference (95% CI) for Bristol Stool Scale	*p*-value
Soluble fiber intake	-0.2 (-0.58 – 0.17)	0.26
Free-lactose ONS	-2.29 (0.31 – 4.27)	0.03*
Energy intake	0.001 (-0.001 – 0.003)	0.23
Antibiotic administration	1.03 (-1.44 – 3.49)	0.37

* $p < 0.05$, *significantly different*

DISCUSSION

Diarrhea in burns is caused by multifactorial, including infection, medications, lactose intolerance, enteral formulas administration, and hypoalbuminemia. Diarrhea in burns represents mucosal failure or intestinal ischemia. Management of diarrhea in burns includes fluid resuscitation and therapy according to the cause of diarrhea.[7]

Dysbiosis increased intestinal permeability, and bacterial translocation was observed in burns in several studies. The ratio of lactulose to mannitol, a surrogate marker for intestinal permeability, was increased starting from the first day of burns and associated with the incidence of sepsis.[8,9]

Soluble fiber has a gel-forming effect, increases viscosity, is rapidly fermented, produces SCFA, and slows down intestinal transit to improve diarrhea. Despite insignificant, dietary modification through administration of 6-10 g/d of soluble fiber in our patient is well tolerated and could support overcoming diarrhea clinically. Meta-analyzes[10] have shown positive results of fiber administration on the incidence of diarrhea in critically ill patients—several things cause the differences found in this case report. First, the cause of diarrhea in critically ill patients from various previous studies is due to enteral nutrition administration, wherein fiber intake will display benefits theoretically. In this case report, the patient did not receive enteral nutrition, and the cause of diarrhea was probably due to an infectious factor. Second, most studies have examined the administration of fiber in the form of supplementation without considering the patient's actual intake. The analysis of fiber intake in this case report is based on the essential input obtained by patients from both food and the ONS.

In our patients, a complete stool examination showed the presence of mucus and bacteria along with nausea and fever. The possibility of gastrointestinal infection had not to be ruled out. Diarrhea improved within four days, as well as improvement in patient intake. The patient's improved intake tolerance also influenced the increase in soluble fiber intake in patients. Increasing energy intake simultaneously increases the patient's intake of soluble fiber. Our multivariate analysis involving lactose-free ONS administration, antibiotic administration, and energy intake as confounding factors exhibited that lactose-free ONS administration was beneficial in significantly improving stool consistency. Burned patients are prone to intestinal mucosal ischemia, which damages the brush border and disrupts lactase production. The impaired lactose digestion subsequently causes lactose intolerance in burned patients. In this circumstance, a lactose-free formula can be an option.[7]

SUMMARY

Administration of 6–10 g/d soluble fiber clinically improves stool consistency, evaluated by Bristol Stool Scale, in burned patients 53.5% TBSA with diarrhea. The administration of soluble fiber combined with lactose-free formula was well tolerated and had a beneficial effect in improving diarrhea in severely burned patients.

Correspondence regarding this article should be addressed to:
Lily Indriani Octovia
Department of Nutrition, Dr. Cipto Mangunkusumo Hospital, Faculty of Medicine Universitas Indonesia, Jakarta, Indonesia.
E-Mail: lily.indriani@gmail.com

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