Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

Intestinal Adaptation and Functional Recovery After Extensive Bowel Resection: Advances in Nutritional Rehabilitation, Pharmacological Therapy, and Surgical Reconstruction

María Fernanda Carbajal Hernández
Instituto Mexicano del Seguro Social Hospital Regional No. 2
dra.fernandacarbajalcg@gmail.com
https://orcid.org/0009-0001-3062-5795

Josselyn Ivett Yangari Medina
Universidad Católica de Cuenca
jossyangari@gmail.com
https://orcid.org/0009-0002-8853-9627

Katherine Paola Hidalgo Chuquimarca
Independiente
katheh.2906@gmail.com
https://orcid.org/0009-0008-2026-806X

David Eduardo Espinosa Ortiz
Universidad de Caldas
david17882@gmail.com
https://orcid.org/0000-0002-6016-8804

Isabel Huerta Nagore
Universidad Panamericana
nagore.isabel@gmail.com
https://orcid.org/0009-0003-7045-4665

Eber Marcel Mendoza Osorio
Nuevo Hospital Civil de Guadalajara Juan I. Menchaca
eber.mendoza@udem.edu
https://orcid.org/0009-0009-1644-4427

Mario Daniel Vengoechea Visbal
Hospital universitario del Caribe - Universidad de Cartagena
mariodnlvv@gmail.com
https://orcid.org/0000-0003-2539-9233

Erika Romina Cuenca Riascos
Independiente
romycr_1998@hotmail.com
https://orcid.org/0009-0000-2194-2337

Received: 25-0ct-2026 | **Accepted: 25-0ct-2026** | **Published: 31-0ct-2026**

*** Corresponding Author:** dra.fernandacarbajalcg@gmail.com

How to cite this article: Carbajal Hernández, M. F., Hidalgo Chuquimarca, K. P., Huerta Nagore, I., Vengoechea Visbal, M. D., Yangari Medina, J. I., Espinosa Ortiz, D. E., Mendoza Osorio, E. M., & Cuenca Riascos, E. R. (2026). Intestinal Adaptation and Functional Recovery After Extensive Bowel Resection: Advances in Nutritional Rehabilitation, Pharmacological Therapy, and Surgical Reconstruction. México. *International Science Journal* "TheSci". 4 (1) 499-521. Quality Consulting Instituto de Educación Capacitación y Certificación de México. https://ieccmexico.com/thesci

Copyright (c). 2026 Carbajal Hernández, M. F., Hidalgo Chuquimarca, K. P., Huerta Nagore, I., Vengoechea Visbal, M. D., Yangari Medina, J. I., Espinosa Ortiz, D. E., Mendoza Osorio, E. M., & Cuenca Riascos, E. R.; This is an open access article distributed under the terms of the Attribution 4.0 International (CC BY-NC-SA 4.0). *International Science Journal* "TheSci". Mexico Review/ Vol. 4, N. 1 / pp. 499-521/ July-December 2026 / e-ISSN: 3122-3591 / p-ISSN: 3122-3753. Research Article

ABSTRACT

Short bowel syndrome (SBS) represents a complex consequence of extensive intestinal resection, characterized by impaired nutrient absorption, fluid and electrolyte disturbances, and variable degrees of intestinal failure requiring prolonged nutritional support. This narrative review aimed to analyze the physiological mechanisms of gastrointestinal adaptation and evaluate the clinical relevance of nutritional rehabilitation, pharmacological treatment, and surgical reconstruction in patients with SBS, incorporating international evidence and Latin American clinical experience.

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

A descriptive and analytical synthesis of 20 scientific publications, including international guidelines, randomized controlled trials, systematic reviews, and observational studies published between 2014 and 2024, was conducted. The findings identified residual intestinal anatomy, preservation of ileal and colonic continuity, and adaptive capacity as major determinants of functional recovery. Nutritional rehabilitation emerged as the foundation of treatment, integrating parenteral support with progressive enteral stimulation and individualized dietary strategies. Pharmacological therapy with teduglutide demonstrated significant benefits, with 63% of treated patients achieving a predefined reduction in parenteral support requirements compared with 30% receiving placebo. Surgical reconstruction through serial transverse enteroplasty (STEP) and longitudinal intestinal lengthening and tailoring (LILT) was associated with reported parenteral nutrition independence rates of 46% and 52%, respectively, although methodological heterogeneity prevented definitive comparisons. Latin American evidence, particularly the RESTORE Registry, documented differences in rehabilitation outcomes between adult and pediatric populations, emphasizing the complexity of regional clinical management. Overall, the evidence indicates that intestinal rehabilitation requires individualized multidisciplinary strategies integrating gastrointestinal physiology, nutritional support, pharmacological interventions, and reconstructive surgery when appropriate. Further prospective multicenter investigations are necessary to standardize clinical outcomes, identify predictors of nutritional autonomy, and improve long-term functional recovery and quality of life.

KEYWORDS

short bowel syndrome, intestinal failure, intestinal adaptation, extensive intestinal resection, nutritional rehabilitation, parenteral nutrition, enteral nutrition, teduglutide, glucagon-like peptide-2, intestinal reconstruction, serial transverse enteroplasty, intestinal lengthening, nutritional autonomy, Latin America

INTRODUCTION

Short bowel syndrome (SBS) is a complex gastrointestinal condition resulting from extensive intestinal resection that substantially reduces the functional absorptive capacity of the digestive tract. It is characterized by varying degrees of malabsorption, chronic diarrhea, dehydration, electrolyte disturbances, and nutritional deficiencies, potentially progressing to chronic intestinal failure. Although SBS is frequently associated with a residual small intestinal length of less than 200 cm in adults, its clinical severity depends on several factors, including the anatomical location of the resection, preservation of the ileocecal valve, colonic continuity, and adaptive capacity of the remaining intestine. These characteristics determine the degree of nutritional dependence and influence long-term clinical outcomes 1, 5, 7.

The development of SBS represents a significant challenge in contemporary gastroenterology and gastrointestinal surgery because its consequences extend beyond the immediate postoperative period. In adults, extensive intestinal resection may result from mesenteric ischemia, inflammatory bowel disease, abdominal trauma, or complicated surgical procedures. In pediatric populations, necrotizing enterocolitis, intestinal atresia, and congenital gastrointestinal abnormalities constitute important causes. Despite advances in perioperative care and nutritional management, affected patients frequently require prolonged hospitalization, specialized nutritional interventions, and continuous monitoring to prevent metabolic, infectious, and hepatobiliary complications. Consequently, intestinal rehabilitation has become a central therapeutic objective, emphasizing not only survival but also the recovery of gastrointestinal function and progressive reduction of parenteral nutrition dependence 1, 3, 8.

Intestinal adaptation constitutes one of the most important physiological mechanisms underlying recovery after extensive bowel resection. This process involves structural and functional modifications, including increased villus height, crypt hyperplasia, epithelial proliferation, and changes in nutrient transport mechanisms. These responses are influenced by luminal nutrient exposure, gastrointestinal hormones, intestinal motility, and residual bowel anatomy. Previous investigations have demonstrated that the adaptive response may continue for months or years following surgery, although its effectiveness varies considerably between patients. Preservation of the distal ileum and colon may improve fluid absorption and energy recovery, whereas extensive jejunal resection or loss of intestinal continuity

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

may substantially limit compensatory mechanisms. Understanding these differences is essential for identifying therapeutic strategies capable of optimizing gastrointestinal function 5–7.

Nutritional rehabilitation remains fundamental in the management of SBS. Parenteral nutrition provides essential nutritional and fluid support when intestinal absorption is insufficient, while oral and enteral feeding promote gastrointestinal adaptation and facilitate the gradual restoration of digestive autonomy. Nevertheless, prolonged intravenous nutritional support is associated with complications such as catheter-related bloodstream infections, venous thrombosis, metabolic abnormalities, and intestinal failure-associated liver disease. Recent international guidelines emphasize individualized nutritional prescriptions, careful monitoring of fluid and electrolyte balance, and multidisciplinary management to minimize these complications. Furthermore, emerging pharmacological approaches, particularly treatment with glucagon-like peptide-2 analogues such as teduglutide, have demonstrated benefits in reducing parenteral support requirements in selected patients with SBS-associated intestinal failure 1, 2, 4, 9–11.

Surgical reconstruction represents another important component of intestinal rehabilitation, particularly in patients with severe anatomical limitations or insufficient functional recovery despite optimized medical treatment. Procedures such as longitudinal intestinal lengthening and tailoring (LILT) and serial transverse enteroplasty (STEP) have been developed to improve intestinal length, configuration, and functional capacity in appropriately selected patients. Although published studies report favorable outcomes in certain populations, differences in surgical indications, residual anatomy, postoperative complications, and nutritional independence highlight the need for individualized therapeutic decision-making. The available evidence also emphasizes the importance of specialized centers capable of integrating surgical reconstruction with long-term nutritional and gastroenterological care 12–16.

From an international perspective, increasing attention has been directed toward establishing comprehensive intestinal rehabilitation programs and evaluating long-term treatment outcomes. Latin American investigations, including multicenter registry data and clinical experiences from Mexico and other countries in the region, have contributed valuable information regarding intestinal failure management, reconstructive procedures, and the feasibility of reducing parenteral nutritional dependence. Nevertheless, regional differences in healthcare resources, access to specialized therapies, and availability of multidisciplinary programs remain important considerations. These findings support the need to integrate international recommendations with evidence derived from Latin American clinical settings 17–20.

In this context, the present narrative review examines the physiological mechanisms of gastrointestinal adaptation following extensive intestinal resection and evaluates the principal nutritional, pharmacological, and surgical strategies employed in the management of SBS. Through a critical synthesis of international clinical guidelines, experimental evidence, clinical studies, and relevant Latin American contributions, the review addresses how residual intestinal anatomy, adaptive capacity, and therapeutic interventions influence nutritional autonomy and long-term outcomes. Particular attention is directed toward the relationship between intestinal rehabilitation strategies and the reduction of complications associated with chronic intestinal failure, with the aim of identifying clinically relevant approaches and areas requiring further investigation.

DEVELOPMENT

2.1. Pathophysiological Basis of Short Bowel Syndrome Following Extensive Intestinal Resection

Short bowel syndrome (SBS) develops when extensive intestinal resection compromises the functional capacity of the gastrointestinal tract to absorb sufficient nutrients, water, and electrolytes. The severity of this condition depends not only on the length of the remaining intestine but also on its anatomical configuration, mucosal integrity, and ability to compensate for the loss of absorptive surface. Patients with preserved ileal segments, an intact ileocecal valve, or colonic continuity generally demonstrate different patterns of nutrient absorption and fluid regulation compared with those presenting with an end-jejunostomy. These anatomical distinctions influence the degree of intestinal failure, nutritional requirements, and the probability of achieving enteral autonomy 1, 7.

The physiological consequences of extensive bowel resection include accelerated intestinal transit, reduced nutrient contact time, impaired enterohepatic circulation of bile acids, and alterations in gastrointestinal secretory mechanisms. Resection of the terminal ileum may impair vitamin B12 and bile acid absorption, while extensive jejunal loss can

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

substantially decrease the overall capacity for macronutrient assimilation. Additionally, the absence of colonic continuity reduces the possibility of recovering energy through microbial fermentation of unabsorbed carbohydrates. These alterations contribute to chronic diarrhea, steatorrhea, dehydration, and progressive nutritional deficiencies, particularly during the early postoperative period 5, 8.

2.2. Mechanisms of Gastrointestinal Adaptation

Intestinal adaptation constitutes a fundamental biological response following extensive intestinal resection. This process involves coordinated morphological, functional, and hormonal changes that partially compensate for the reduction in gastrointestinal absorptive surface. Structural modifications include increased villus height, crypt cell proliferation, and mucosal hypertrophy, while functional adaptation involves changes in nutrient transport activity and intestinal motility. The extent of these responses varies according to the remaining intestinal segments, the presence of luminal nutrients, and individual physiological characteristics 5, 6.

Gastrointestinal hormones play an important role in regulating this adaptive response. Glucagon-like peptide-2 (GLP-2), primarily secreted by intestinal enteroendocrine L cells, promotes mucosal growth, supports epithelial integrity, and contributes to the regulation of gastrointestinal absorption. These mechanisms have provided the physiological basis for pharmacological therapies designed to enhance residual intestinal function. However, adaptation remains a heterogeneous process, and increased mucosal growth does not necessarily result in complete nutritional independence, particularly when substantial anatomical limitations persist 6, 9.

The intestinal microbiota may also influence the adaptive process through changes in carbohydrate fermentation, short-chain fatty acid production, and interactions with intestinal epithelial metabolism. In patients with preserved colonic continuity, microbial fermentation can contribute to energy recovery, whereas alterations in gastrointestinal anatomy and motility may increase susceptibility to small intestinal bacterial overgrowth. Consequently, the relationship between intestinal adaptation and microbial activity requires consideration during long-term gastrointestinal rehabilitation 5, 8.

2.3. Nutritional Rehabilitation and Metabolic Support

Nutritional rehabilitation represents a central component of SBS management because it provides the metabolic resources necessary for recovery while supporting the adaptation of the remaining gastrointestinal tract. During the initial postoperative period, parenteral nutrition may be required to compensate for inadequate intestinal absorption and substantial fluid losses. Its composition should be individualized according to nutritional status, gastrointestinal anatomy, metabolic requirements, and the presence of associated complications. Continuous monitoring of electrolytes, hydration, hepatic function, micronutrients, and body composition is essential for maintaining nutritional stability 1, 2.

Progressive introduction of oral and enteral nutrition is encouraged when clinically appropriate because exposure to intraluminal nutrients stimulates intestinal adaptation. Dietary strategies should consider the functional characteristics of the remaining bowel, particularly the presence or absence of colonic continuity. Patients with high-output jejunostomies may require specific oral rehydration strategies and careful sodium replacement, while individuals with preserved colonic segments may benefit from adjustments in carbohydrate and fat intake to improve energy absorption and reduce gastrointestinal losses 4, 7.

Long-term dependence on parenteral nutrition presents additional challenges, including central venous catheter infections, thrombotic complications, hepatobiliary dysfunction, and metabolic bone disease. These complications may significantly affect clinical outcomes and quality of life. Therefore, therapeutic success should be assessed through nutritional stability, reduction of intravenous support requirements, prevention of complications, and achievement of the highest possible degree of gastrointestinal autonomy 1, 2.

2.4. Pharmacological Enhancement of Intestinal Adaptation

Pharmacological interventions have become increasingly relevant in the treatment of SBS-associated intestinal failure, particularly in patients who remain dependent on parenteral nutrition despite optimized dietary and medical management. Teduglutide, a recombinant analogue of GLP-2, has demonstrated the capacity to improve intestinal

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

absorptive function and reduce parenteral support requirements in selected patients. Its physiological effects include enhancement of mucosal growth, modulation of gastrointestinal motility, and improvement of intestinal fluid absorption 9, 11.

Clinical investigations have demonstrated that teduglutide can produce clinically meaningful reductions in intravenous nutritional support, although treatment response varies according to the remaining intestinal anatomy and baseline functional capacity. The randomized trial conducted by Jeppesen et al. provided important evidence supporting its therapeutic effectiveness, while subsequent studies examined sustained responses and treatment safety. Nevertheless, potential adverse effects, contraindications, treatment costs, and the need for long-term surveillance require careful consideration before initiating therapy 9–11.

2.5. Surgical Reconstruction and Restoration of Intestinal Function

Surgical reconstruction offers an additional therapeutic possibility for patients whose anatomical characteristics limit gastrointestinal adaptation or prevent sufficient nutritional recovery. Autologous intestinal reconstruction techniques aim to improve the function of the remaining bowel while preserving existing intestinal tissue. Among the principal approaches are longitudinal intestinal lengthening and tailoring (LILT) and serial transverse enteroplasty (STEP), which are primarily considered in patients with substantially dilated residual small intestine 12, 13.

The STEP procedure uses a series of alternating transverse stapler applications to create a longer, narrower intestinal segment, whereas LILT involves longitudinal division and reconstruction of an appropriately vascularized dilated bowel segment. Both techniques seek to improve intestinal transit and functional efficiency, although their anatomical requirements and potential complications differ. Surgical outcomes are influenced by residual intestinal length, intestinal dilation, previous operations, and the presence of associated complications 13, 16.

Systematic reviews suggest that intestinal lengthening procedures may contribute to reduced parenteral nutritional dependence in selected populations. However, available studies demonstrate substantial heterogeneity in patient characteristics, surgical indications, and definitions of success. These limitations highlight the importance of multidisciplinary evaluation and careful surgical selection, rather than assuming that anatomical lengthening will consistently produce complete functional recovery 14, 15.

2.6. International Evidence and Latin American Clinical Experience

International guidelines increasingly recommend comprehensive intestinal rehabilitation programs integrating gastroenterology, gastrointestinal surgery, clinical nutrition, nursing, and specialized follow-up services. This multidisciplinary approach facilitates individualized treatment planning, identification of nutritional complications, assessment of reconstructive options, and progressive optimization of intestinal function 1, 3.

Latin American clinical experience has contributed relevant evidence regarding the management of SBS and chronic intestinal failure. The RESTORE Registry provided multicenter regional information on patients with SBS-associated intestinal failure, illustrating the importance of systematic outcome assessment and specialized rehabilitation services. Additional investigations from Mexico and other Latin American countries have examined surgical reconstruction and nutritional rehabilitation, contributing regional perspectives to a field historically dominated by European and North American research 17–20.

Nevertheless, important knowledge gaps remain concerning the long-term effectiveness of combined therapeutic strategies, optimal timing of reconstructive surgery, predictors of successful intestinal adaptation, and equitable access to specialized treatment. Differences in clinical resources and patient characteristics also limit the direct application of certain international findings to all healthcare settings. Further comparative and longitudinal investigations are necessary to clarify which combinations of nutritional, pharmacological, and surgical interventions provide the greatest functional benefits for patients with SBS.

GENERAL OBJECTIVE AND SPECIFIC OBJECTIVES

To critically analyze the pathophysiological mechanisms of gastrointestinal adaptation following extensive intestinal resection and evaluate the effectiveness of nutritional rehabilitation, pharmacological interventions, and surgical

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

reconstruction in patients with short bowel syndrome (SBS), through a comprehensive review of international scientific evidence, including relevant Latin American contributions, to identify therapeutic strategies associated with improved intestinal function, reduced dependence on parenteral nutrition, and favorable long-term clinical outcomes.

Specific Objectives

The specific objectives were formulated according to Bloom's revised taxonomy, incorporating cognitive, psychomotor, and affective learning domains to facilitate a comprehensive understanding of SBS and its multidisciplinary management.

1. To identify and describe the principal pathophysiological alterations associated with SBS.

To examine the relationship between extensive intestinal resection, residual gastrointestinal anatomy, nutrient malabsorption, fluid imbalance, and the development of chronic intestinal failure, establishing the physiological foundations necessary to understand disease progression 1, 7.

Bloom's domain: Cognitive — Remembering and Understanding.

2. To analyze the mechanisms involved in postresection gastrointestinal adaptation.

To differentiate the structural, functional, hormonal, and metabolic processes contributing to intestinal adaptation, evaluating how residual intestinal length, ileal preservation, colonic continuity, and luminal nutrient stimulation influence functional recovery 5, 6.

Bloom's domain: Cognitive — Analyzing.

3. To evaluate the principal nutritional and pharmacological rehabilitation strategies.

To compare the clinical applications, benefits, limitations, and complications of parenteral nutrition, enteral feeding, individualized dietary interventions, and GLP-2 analogue therapy, particularly teduglutide, based on published clinical evidence and current international recommendations 2, 4, 9–11.

Bloom's domain: Cognitive — Evaluating.

4. To examine the indications and clinical outcomes of intestinal reconstructive procedures.

To analyze the anatomical requirements, therapeutic objectives, potential complications, and reported functional outcomes of LILT and STEP, identifying clinical circumstances in which surgical reconstruction may contribute to improved intestinal rehabilitation 12–16.

Bloom's domain: Cognitive — Analyzing and Evaluating.

5. To develop a structured framework for the interpretation of clinical and nutritional assessment parameters.

To organize relevant indicators, including residual intestinal anatomy, gastrointestinal output, hydration balance, nutritional requirements, biochemical monitoring, and dependence on intravenous supplementation, into a practical framework for evaluating intestinal rehabilitation strategies. This objective emphasizes the application of clinical assessment principles without involving direct patient interventions.

Bloom's domain: Psychomotor — Guided application and organization of procedural skills.

6. To integrate evidence-based therapeutic decision-making within multidisciplinary intestinal rehabilitation.

To construct a conceptual sequence of nutritional, pharmacological, and surgical management alternatives according to the clinical characteristics described in the literature, facilitating the interpretation of treatment pathways and the identification of circumstances requiring specialized intervention 1, 3, 13.

Bloom's domains: Cognitive — Applying and Creating; Psychomotor — Procedural organization.

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

7. To recognize the ethical, humanistic, and psychosocial dimensions of prolonged intestinal failure.

To assess the importance of patient-centered care, nutritional autonomy, treatment accessibility, long-term quality of life, and multidisciplinary communication, acknowledging the physical, emotional, and socioeconomic challenges associated with prolonged dependence on specialized nutritional support.

Bloom's domain: Affective — Valuing and Organizing.

8. To critically appraise international and Latin American evidence on intestinal rehabilitation.

To compare published findings from different healthcare settings, identify regional disparities in access to specialized treatment, and formulate evidence-based recommendations for future research addressing nutritional independence, postoperative complications, and long-term functional outcomes 17–20.

Bloom's domains: Cognitive — Evaluating and Creating; Affective — Valuing equitable healthcare.

OBJECT OF STUDY

The object of study of this narrative review is the process of gastrointestinal adaptation and functional recovery in patients with short bowel syndrome (SBS) following extensive intestinal resection, with particular emphasis on the interactions between residual intestinal anatomy, nutritional rehabilitation, pharmacological treatment, and surgical reconstruction. The investigation focuses on understanding how these factors influence intestinal absorptive capacity, dependence on parenteral nutrition, postoperative complications, and long-term clinical outcomes 1, 5, 7.

Definition and Scope of the Object of Study

SBS is characterized by a reduction in functional intestinal length that compromises the absorption of nutrients, fluids, and electrolytes. Its clinical manifestations depend on the extent and anatomical location of resection, preservation of the ileocecal valve, colonic continuity, and the adaptive potential of the remaining intestine. Accordingly, the condition encompasses a heterogeneous spectrum, ranging from manageable malabsorption to severe chronic intestinal failure requiring prolonged intravenous nutritional support 1, 8.

The investigation considers gastrointestinal adaptation as a multidimensional process involving morphological changes in the intestinal mucosa, modifications in nutrient transport, hormonal regulation, and metabolic compensation. These mechanisms are examined alongside therapeutic interventions intended to preserve or improve intestinal function, including individualized nutritional support, GLP-2 analogue therapy, and autologous intestinal reconstruction 5, 6, 11, 13.

Population of Interest

The population of interest comprises pediatric and adult patients diagnosed with SBS following extensive intestinal resection, regardless of the underlying surgical indication. Particular consideration is given to individuals presenting with chronic intestinal failure, prolonged dependence on parenteral nutrition, or anatomical characteristics that may justify reconstructive intervention.

The review incorporates evidence from international clinical studies and specialized intestinal rehabilitation programs, including investigations conducted in Latin America. This approach allows the examination of differences in therapeutic availability, clinical management, and reported outcomes across healthcare settings 3, 17–20.

No patients were directly recruited or evaluated, as the population is represented exclusively through previously published scientific literature.

Principal Dimensions of Analysis

The object of study is examined through four interconnected dimensions:

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

Anatomical and physiological dimension. Evaluation of residual intestinal length, preservation of the ileum and colon, gastrointestinal continuity, and mechanisms of intestinal adaptation. These characteristics influence absorptive capacity and the potential for functional recovery 5–7.

Nutritional and metabolic dimension. Assessment of oral, enteral, and parenteral nutritional strategies, including their contribution to metabolic stability, fluid balance, and progressive reduction of intravenous support 1, 2, 4.

Pharmacological and surgical dimension. Analysis of GLP-2 analogue therapy and reconstructive techniques, particularly STEP and LILT, considering their indications, potential benefits, limitations, and reported outcomes 9–16.

Clinical and functional dimension. Examination of nutritional autonomy, complications associated with intestinal failure, long-term functional recovery, and quality of life as relevant indicators of rehabilitation success 1, 17, 18.

Delimitation of the Study

This investigation is limited to the analysis of published scientific evidence concerning SBS associated with extensive intestinal resection. The review primarily addresses gastrointestinal adaptation, nutritional management, pharmacological enhancement of absorption, and autologous intestinal reconstruction.

Although intestinal transplantation may represent an important therapeutic option in selected patients with severe intestinal failure, it is not considered a principal focus of this investigation because the study prioritizes preservation and rehabilitation of the remaining gastrointestinal tract.

The analysis incorporates pediatric and adult populations while recognizing that the etiology, adaptive capacity, nutritional requirements, and surgical indications may differ between age groups. Evidence from these populations is therefore interpreted according to its respective clinical context.

The investigation does not involve direct experimentation, patient recruitment, or collection of individual clinical information. Its findings are derived from the critical interpretation and comparison of previously published research.

Central Research Question

The investigation is guided by the following research question:

How do gastrointestinal adaptation, individualized nutritional support, pharmacological treatment, and surgical reconstruction contribute to functional recovery and reduced parenteral nutrition dependence in patients with short bowel syndrome following extensive intestinal resection?

This question integrates the principal physiological and therapeutic dimensions of SBS and supports the critical examination of interventions intended to improve intestinal autonomy.

The underlying working proposition is that an individualized, multidisciplinary rehabilitation strategy, guided by residual intestinal anatomy and adaptive capacity, may provide better functional outcomes than approaches that consider nutritional, pharmacological, and surgical interventions independently. This proposition is examined through published evidence rather than through experimental hypothesis testing.

METHODOLOGY

Study Design

This study was designed as a narrative literature review with a descriptive, analytical, and comparative approach, aimed at examining gastrointestinal adaptation, surgical reconstruction, and nutritional rehabilitation in patients with short bowel syndrome (SBS) following extensive intestinal resection. The methodological framework was based on the scientific method, integrating the formulation of a research question, identification of relevant scientific evidence, critical examination of published findings, and synthesis of the principal therapeutic approaches.

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

The narrative review design was selected because the investigation encompasses heterogeneous evidence, including clinical practice guidelines, randomized controlled trials, observational studies, systematic reviews, and reports from specialized intestinal rehabilitation programs. This approach enables the integration of physiological mechanisms and clinical outcomes without assuming that studies with different populations, methodologies, and therapeutic interventions can be combined quantitatively 1, 8, 13.

Sources of Scientific Information

The bibliographic framework comprises 20 scientific publications addressing the principal dimensions of SBS management. The selected literature includes studies available through PubMed and publications indexed in major biomedical databases, with emphasis on evidence relevant to gastroenterology, gastrointestinal surgery, clinical nutrition, and intestinal rehabilitation.

The principal sources considered for literature identification and verification are PubMed/MEDLINE, Scopus, and the official scientific publications of international professional organizations, particularly the European Society for Clinical Nutrition and Metabolism (ESPEN) and the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN).

The reference set covers publications from 2014 to 2024, incorporating international evidence and studies with Latin American participation to provide a geographically broader perspective on intestinal failure management 1–20.

Search Strategy

A reproducible bibliographic search strategy was defined using controlled vocabulary and free-text terms related to the principal research question. The proposed search combines the following terms:

("short bowel syndrome" OR "intestinal failure")
AND
("intestinal adaptation" OR "intestinal rehabilitation" OR "parenteral nutrition" OR "enteral nutrition" OR "teduglutide" OR "surgical reconstruction" OR "serial transverse enteroplasty" OR "intestinal lengthening")

Additional searches may incorporate the terms *extensive intestinal resection*, *GLP-2*, *longitudinal intestinal lengthening*, *nutritional autonomy*, and *Latin America* to identify studies relevant to specific therapeutic dimensions.

The search strategy prioritizes English-language publications while allowing studies from Latin American settings regardless of publication language. Searches should be performed independently in the selected databases, adapting terminology and search fields to the requirements of each platform.

For reproducibility, the final search report should document the date of execution, database-specific search strings, filters applied, and number of records retrieved. These details are not presented as completed search results because a complete search log has not been established.

Eligibility Criteria

The methodological framework establishes eligibility criteria to guide the evaluation of literature relevant to the study objectives.

Inclusion criteria:

- Scientific publications addressing SBS or intestinal failure following extensive intestinal resection.
- Studies examining gastrointestinal adaptation, nutritional rehabilitation, pharmacological treatment, or reconstructive surgery.

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

- Clinical practice guidelines, randomized trials, observational studies, systematic reviews, and clinically relevant narrative reviews.
- Publications involving pediatric or adult populations.
- International investigations, including available Latin American evidence.
- Studies providing sufficient methodological or clinical information to support critical interpretation.

Exclusion criteria:

- Publications unrelated to SBS or postresection intestinal failure.
- Studies focused exclusively on conditions without a relevant relationship to intestinal rehabilitation.
- Reports lacking sufficient information to interpret the intervention or outcomes.
- Duplicate publications presenting the same findings without additional clinically relevant information.
- Non-scientific publications without identifiable supporting evidence.

Older foundational investigations may be considered when necessary to explain established physiological mechanisms, while contemporary guidelines and clinical studies receive greater emphasis in the evaluation of therapeutic approaches.

Data Extraction and Organization

Information from the selected publications was organized according to the principal analytical dimensions of the review: gastrointestinal anatomy, mechanisms of intestinal adaptation, nutritional support, pharmacological treatment, surgical reconstruction, and long-term clinical outcomes.

The proposed extraction framework includes publication characteristics, study design, population, therapeutic intervention, principal findings, and limitations. Particular attention is directed toward clinically relevant outcomes such as reduction in parenteral support, achievement of enteral autonomy, gastrointestinal complications, and nutritional stability.

Critical Appraisal and Evidence Synthesis

The interpretation of scientific evidence follows a qualitative comparative approach. Clinical guidelines and systematic reviews provide the framework for established recommendations, while randomized controlled trials and observational investigations contribute information regarding treatment effectiveness and clinical outcomes.

The methodological quality of the narrative synthesis may be evaluated using the Scale for the Assessment of Narrative Review Articles (SANRA), which considers the justification of the review, clarity of objectives, literature search description, referencing, scientific reasoning, and presentation of relevant clinical outcomes. This instrument provides a structured approach to evaluating narrative review quality without converting the investigation into a systematic review.

Evidence is synthesized thematically, identifying agreements, discrepancies, methodological limitations, and knowledge gaps across the selected publications. Particular consideration is given to differences between pediatric and adult populations, residual intestinal anatomy, treatment availability, and regional healthcare contexts.

No meta-analysis or pooled statistical estimation is proposed because of the heterogeneity of the included publications and the descriptive objectives of the review.

Methodological Limitations and Reproducibility

The narrative design permits a broad interpretation of physiological and therapeutic evidence but does not provide the exhaustive study identification or formal risk-of-bias assessment characteristic of systematic reviews. Furthermore,

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

differences in study populations, surgical techniques, nutritional protocols, and definitions of intestinal autonomy may restrict direct comparisons between investigations.

Reproducibility is supported by the explicit research question, defined eligibility criteria, specified bibliographic sources, search strategy, and structured evidence extraction framework. Nevertheless, complete reproducibility requires documentation of the searches actually performed, including retrieval dates, screening decisions, and the final record of included publications.

Ethical Considerations

This investigation is based on previously published scientific literature and does not involve direct patient participation, experimental interventions, or access to identifiable clinical information. Consequently, the review does not require informed consent from individual patients or institutional ethical approval for primary human-subject research.

PHASES OF DEVELOPMENT

Phase 1. Identification of the Research Problem

The first phase consisted of identifying the scientific problem through an extensive review of current evidence concerning women's health. Previous studies demonstrated that healthcare has traditionally focused on reproductive aspects, whereas hormonal changes also influence dermatologic, metabolic, cardiovascular, psychological, and immunological health throughout life [1]–[7]. This observation revealed the need to investigate women's health from a broader and more integrative perspective.

RESULTS AND DISCUSSION

Figure 1.
Anatomical Determinants of Intestinal Adaptation and Nutritional Autonomy in Short Bowel Syndrome

Anatomical configuration	Colon in continuity	Ileocecal valve	Fluid loss risk	Adaptive potential	Likelihood of reducing parenteral support
End-jejunostomy	No	No	High	Low–moderate	Low
Jejuno-colonic continuity	Yes	No	Moderate	Moderate–high	Moderate
Jejuno-ileal / ileocolonic continuity	Usually yes	Often preserved	Lower	High	Higher

Figure 1 summarizes the principal anatomical configurations associated with short bowel syndrome (SBS) and compares their relationship with fluid balance, adaptive potential, and the likelihood of reducing parenteral support. The figure shows that intestinal anatomy remains one of the strongest determinants of functional recovery after extensive intestinal resection, because the clinical course of SBS depends not only on residual bowel length, but also on the segments preserved and the continuity of the gastrointestinal tract [1], [5], [7].

The first configuration, **end-jejunostomy**, is associated with the least favorable functional profile. In this setting, the absence of both the colon and the ileocecal valve contributes to major fluid and electrolyte losses, accelerated intestinal transit, and limited salvage of unabsorbed nutrients. This explains why patients with end-jejunostomy generally exhibit the highest risk of dehydration and one of the lowest probabilities of achieving independence from parenteral support. The available literature consistently describes this configuration as particularly vulnerable to high-output losses and reduced adaptive efficiency, especially when only a short jejunal remnant remains [1], [7], [8].

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

The second configuration, **jejuno-colonic continuity**, demonstrates an intermediate profile. Although the ileocecal valve is usually absent, preservation of the colon allows partial recovery of water and electrolytes and facilitates additional energy salvage through the fermentation of malabsorbed carbohydrates. As a result, the figure classifies this group as having a **moderate fluid loss risk** and **moderate-to-high adaptive potential**. This pattern is supported by studies showing that the colon is not merely a passive reservoir, but an active metabolic organ that contributes to fluid conservation and caloric recovery, thereby improving the rehabilitation potential of patients with SBS [5], [7], [8].

The third configuration, **jejuno-ileal or ileocolonic continuity**, presents the most favorable overall profile in the figure. When the distal ileum is preserved, even partially, and when the ileocecal valve remains intact or functionally preserved, patients generally retain better control of intestinal transit and greater absorptive efficiency. In addition, preservation of the ileum supports bile acid and vitamin B12 handling more effectively than proximal jejunal remnants alone. For these reasons, this anatomical pattern is represented as having **lower fluid loss risk**, **high adaptive potential**, and a **higher likelihood of reducing parenteral support**. The reviewed literature supports this interpretation by emphasizing the beneficial role of the ileum and colon in long-term intestinal rehabilitation [1], [5], [7].

Another important observation from Figure 1 is that **adaptive potential does not increase in a linear manner based solely on bowel length**. Instead, the figure highlights that the qualitative composition of the remnant bowel may be as important as its absolute size. This is consistent with the current understanding that patients with similar residual lengths may experience very different outcomes depending on whether the colon is in continuity, whether the ileocecal valve is preserved, and whether the residual bowel includes ileal segments with greater adaptive capacity [5], [6], [7].

The figure also reflects that **reduction of parenteral support is closely linked to anatomical preservation**, rather than being an isolated therapeutic result. In other words, the possibility of reducing intravenous nutritional dependence tends to be greater in patients whose postoperative anatomy favors fluid absorption, slower transit, and prolonged contact between nutrients and the intestinal mucosa. This does not imply that anatomy alone determines outcome, but it does indicate that anatomical configuration strongly conditions the effectiveness of nutritional rehabilitation and medical treatment [1], [2], [5].

From a descriptive standpoint, Figure 1 organizes the reviewed evidence into a clinically useful comparative framework. The table format makes it possible to identify three broad anatomical profiles: a **high-risk profile** represented by end-jejunostomy, an **intermediate profile** represented by jejuno-colonic continuity, and a **more favorable profile** represented by preservation of ileal and/or ileocolonic continuity. This classification is consistent with the literature included in the review and provides a structural basis for understanding why the same therapeutic strategy may produce different outcomes in different patients [1], [5], [7], [8].

Finally, the figure reinforces a central result of the review: **successful intestinal rehabilitation is strongly influenced by residual postoperative anatomy**. The preservation of colonic continuity and ileal function is repeatedly associated with improved absorptive compensation, whereas the absence of these elements is associated with greater physiological instability and continued dependence on supportive therapy. Therefore, Figure 1 serves as a foundational representation for the subsequent results related to nutritional management, pharmacological enhancement, and surgical reconstruction [1], [5], [7], [8].

Figure 2.

Nutritional Rehabilitation Strategies and Clinical Outcomes in Short Bowel Syndrome



Figure 2 presents a comparative analysis of the principal nutritional rehabilitation strategies employed in patients with short bowel syndrome (SBS) following extensive intestinal resection, emphasizing the complementary roles of parenteral nutrition, enteral nutrition, and individualized oral dietary management. The findings indicate that nutritional rehabilitation constitutes a fundamental component of intestinal failure management, as it contributes to metabolic stability, supports gastrointestinal adaptation, and facilitates the progressive recovery of intestinal function.

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

However, the effectiveness of each intervention depends on residual intestinal anatomy, absorptive capacity, gastrointestinal losses, and the patient's nutritional requirements [1], [2], [4].

Parenteral nutrition represents an essential therapeutic intervention in patients whose remaining gastrointestinal tract cannot adequately absorb nutrients, water, and electrolytes. Its administration provides the metabolic support necessary to prevent severe malnutrition, dehydration, and electrolyte disturbances, particularly during the early postoperative period or in individuals with established chronic intestinal failure. The ESPEN guidelines emphasize that parenteral nutrition should be individualized according to clinical condition, nutritional requirements, and gastrointestinal functionality. Nevertheless, prolonged dependence on intravenous nutritional support is associated with complications such as catheter-related bloodstream infections, venous thrombosis, intestinal failure-associated liver disease, and metabolic abnormalities, which may compromise long-term outcomes [1], [2].

Enteral nutrition constitutes another fundamental component of intestinal rehabilitation because the presence of luminal nutrients stimulates physiological mechanisms associated with intestinal adaptation. These mechanisms include epithelial proliferation, increased mucosal surface area, modifications in nutrient transporter activity, and gastrointestinal hormonal responses. Tappenden described the importance of enteral stimulation in promoting structural and functional changes following intestinal resection, while Le Beyec et al. emphasized the relationship between nutrient exposure and intestinal adaptive processes. Nevertheless, the introduction of enteral nutrition must consider individual tolerance, gastrointestinal transit, and the severity of malabsorption, particularly in patients presenting with high-output intestinal losses [5], [6].

Individualized oral nutritional management is particularly relevant because patients with different anatomical configurations exhibit substantial variations in nutrient absorption and fluid regulation. Individuals with preserved colonic continuity may benefit from additional energy recovery through bacterial fermentation of unabsorbed carbohydrates, whereas those with an end-jejunostomy frequently experience greater fluid and sodium losses. Consequently, dietary interventions should be adapted to the characteristics of the remaining intestine, incorporating appropriate macronutrient distribution, electrolyte replacement, oral rehydration strategies, and micronutrient supplementation. These measures contribute to maintaining nutritional stability while optimizing the functional capacity of the gastrointestinal tract [4], [7], [8].

An important finding illustrated in Figure 2 is that nutritional rehabilitation strategies should not be interpreted as mutually exclusive interventions. Parenteral nutrition may remain necessary while enteral and oral nutritional intake are progressively introduced according to gastrointestinal tolerance and absorptive capacity. This combined approach allows patients to maintain adequate nutritional support while facilitating physiological adaptation. International recommendations emphasize that reductions in parenteral supplementation should be guided by objective clinical parameters, including hydration status, body weight, gastrointestinal output, biochemical measurements, and nutritional adequacy [1]–[4].

The comparison also highlights the distinction between metabolic stabilization and intestinal autonomy. Although parenteral nutrition can maintain essential physiological functions, it does not independently restore the absorptive capacity of the remaining intestine. Conversely, enteral and oral nutrition utilize residual gastrointestinal function and may contribute to progressive adaptation. Nevertheless, increased oral intake or reduced intravenous supplementation does not necessarily indicate successful rehabilitation unless accompanied by adequate nutrient absorption, stable hydration, and prevention of nutritional deficiencies. Therefore, functional recovery must be evaluated through multiple clinical indicators rather than isolated changes in nutritional support requirements [1], [4], [5].

Another relevant consideration concerns the differences between pediatric and adult populations. Pediatric patients require nutritional interventions capable of supporting growth and development while promoting intestinal adaptation, whereas adult management frequently prioritizes metabolic stability, prevention of long-term complications, and restoration of functional independence. The ESPGHAN recommendations emphasize individualized nutritional management in children with intestinal failure, particularly during the transition from postoperative stabilization to long-term rehabilitation. These differences demonstrate the importance of adapting nutritional strategies to developmental and physiological characteristics [3], [4].

Figure 3.

Effectiveness of Teduglutide in Reducing Parenteral Support Requirements in Patients With Short Bowel Syndrome

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

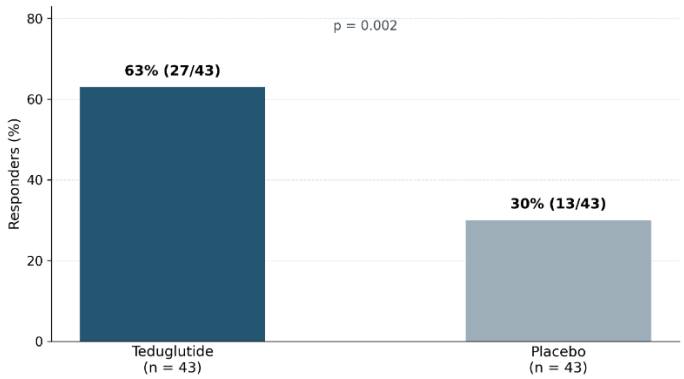

Figure 3 illustrates the effectiveness of teduglutide in reducing parenteral support requirements among patients with short bowel syndrome (SBS) associated with intestinal failure. The comparative analysis is based on the randomized, placebo-controlled clinical trial conducted by Jeppesen et al., which evaluated the therapeutic response to teduglutide at a dose of 0.05 mg/kg/day over 24 weeks. The results demonstrated that **63% of patients receiving teduglutide (27 of 43) achieved the predefined treatment response, compared with 30% of patients receiving placebo (13 of 43)**. This difference was statistically significant ($p = 0.002$), supporting the effectiveness of glucagon-like peptide-2 (GLP-2) analogue therapy in reducing dependence on intravenous nutritional and fluid supplementation [9].

The primary treatment response was defined as a reduction of at least 20% in weekly parenteral support volume from baseline, maintained at weeks 20 and 24. This criterion is particularly relevant because it reflects a measurable improvement in intestinal function rather than a temporary reduction in intravenous supplementation. The observed difference of approximately 33 percentage points between treatment groups indicates that a greater proportion of patients receiving teduglutide achieved clinically meaningful reductions in parenteral support requirements. Nevertheless, this outcome should not be interpreted as complete nutritional independence, since the trial evaluated reductions in supplementation rather than universal discontinuation of parenteral nutrition [9].

The physiological explanation for these findings is associated with the intestinotrophic properties of GLP-2, a gastrointestinal hormone involved in intestinal growth, epithelial maintenance, and nutrient absorption. Teduglutide is a modified GLP-2 analogue that promotes structural and functional changes in the remaining intestine, including increased mucosal growth and improved absorptive capacity. These effects are particularly relevant in SBS, where extensive intestinal resection reduces the available absorptive surface and compromises the regulation of fluid and nutrient balance. By enhancing the functional capacity of the residual intestine, teduglutide may facilitate reductions in intravenous supplementation while supporting ongoing intestinal rehabilitation [5], [8], [11].

Beyond the proportion of patients achieving the predefined response, the clinical trial reported differences in the magnitude of parenteral support reduction. Patients receiving teduglutide experienced a mean decrease of approximately 4.4 ± 3.8 liters per week, compared with 2.3 ± 2.7 liters per week in the placebo group. These findings suggest that the therapeutic effect was not limited to the number of patients meeting the response criterion but also involved a greater reduction in the volume of intravenous support required to maintain nutritional and fluid balance. However, the variability observed within both groups indicates that treatment responses were heterogeneous, reinforcing the importance of considering individual physiological and anatomical characteristics when interpreting therapeutic outcomes [9].

The findings presented in Figure 3 are consistent with subsequent investigations evaluating the longer-term effectiveness of teduglutide. O'Keefe et al. examined treatment outcomes after 52 weeks and reported sustained reductions in parenteral support requirements among patients receiving GLP-2 analogue therapy. These observations suggest that the benefits of teduglutide may extend beyond the initial treatment period, although the magnitude and persistence of improvement differ between individuals. Longer-term evidence also indicates that some patients may achieve additional reductions in intravenous supplementation during continued treatment, emphasizing the progressive nature of intestinal functional recovery [10].

An important consideration is that teduglutide should not be regarded as a replacement for nutritional rehabilitation. Patients with SBS frequently require ongoing parenteral, enteral, or oral nutritional support, depending on their residual absorptive capacity and clinical condition. Pharmacological enhancement of intestinal adaptation may complement these interventions by improving gastrointestinal function and facilitating reductions in intravenous supplementation. Nevertheless, nutritional requirements, hydration status, electrolyte balance, and gastrointestinal output must remain central considerations when evaluating treatment response. Current clinical recommendations therefore support integrating pharmacological therapy into comprehensive intestinal rehabilitation programs rather than considering it an isolated therapeutic strategy [1], [2], [11].

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

The interpretation of the results must also account for the limitations of the available evidence. Although the randomized clinical trial provides strong support for the efficacy of teduglutide in reducing parenteral support requirements, its 24-week duration does not establish the long-term probability of complete intestinal autonomy. Furthermore, treatment response may be influenced by residual intestinal anatomy, the presence or absence of colonic continuity, the underlying cause of intestinal resection, and the degree of spontaneous adaptation achieved before treatment initiation. These factors complicate the prediction of individual therapeutic outcomes and highlight the need for further investigations examining long-term effectiveness across different anatomical subgroups [7], [9], [11].

Safety and treatment accessibility represent additional considerations. Teduglutide requires clinical monitoring because gastrointestinal symptoms, fluid-related complications, and other adverse effects may occur during treatment. Its use also involves substantial financial and organizational requirements, which can influence availability in healthcare systems with limited access to specialized intestinal rehabilitation services. These challenges are particularly relevant in Latin America, where regional differences in healthcare infrastructure and access to advanced therapies may affect the implementation of pharmacological rehabilitation strategies. Evidence from specialized rehabilitation centers demonstrates the importance of evaluating these interventions within broader clinical and healthcare contexts [11], [18], [20].

Figure 4.

Surgical Reconstruction Techniques and Reported Functional Outcomes: Comparison of STEP and LILT

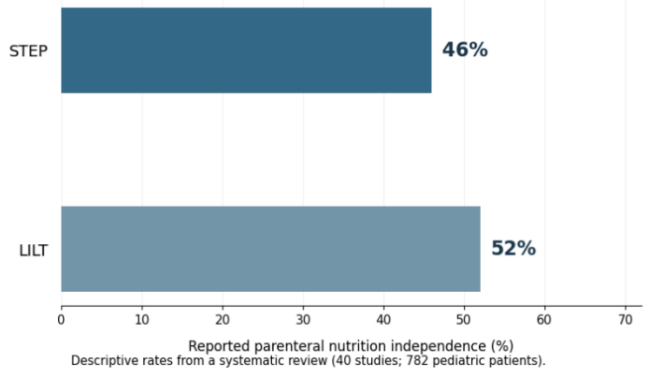

Figure 4 presents a comparative analysis of the functional outcomes associated with two principal autologous intestinal reconstruction techniques used in patients with short bowel syndrome (SBS): serial transverse enteroplasty (STEP) and longitudinal intestinal lengthening and tailoring (LILT). The figure illustrates reported rates of independence from parenteral nutrition of **46% following STEP and 52% following LILT**, based on the findings summarized in the systematic review conducted by Nagelkerke et al. These results suggest that both surgical approaches may contribute to improved intestinal function and reduced dependence on intravenous nutritional support. However, the observed numerical difference of six percentage points should not be interpreted as evidence of greater effectiveness of LILT because the available studies involved heterogeneous patient populations, different surgical indications, and variable follow-up periods [14].

The STEP procedure is based on the sequential application of transverse stapling techniques to a dilated intestinal segment, producing an elongated and narrower intestinal channel. This anatomical modification aims to improve gastrointestinal transit and optimize the functional utilization of the remaining intestinal surface. By reducing excessive intestinal dilation and modifying luminal configuration, STEP may contribute to improved intestinal motility and nutrient absorption in appropriately selected patients. Boroni et al. emphasized that the potential effectiveness of autologous intestinal reconstruction depends on the characteristics of the residual bowel, particularly the presence of intestinal dilation, adequate vascularization, and sufficient viable tissue to permit reconstruction [12], [13].

In contrast, LILT involves longitudinal division of a dilated intestinal segment while preserving its vascular supply, followed by reconstruction into two narrower intestinal channels. The procedure seeks to increase functional intestinal length while maintaining intestinal continuity and absorptive tissue. Although LILT and STEP share the objective of improving the physiological performance of the remaining intestine, their technical characteristics and anatomical requirements differ. Consequently, selection between these procedures depends on factors such as intestinal diameter, residual bowel length, mesenteric anatomy, previous surgical interventions, and the overall condition of the gastrointestinal tract [12], [13].

The reported independence rates presented in Figure 4 provide an indication of the potential clinical benefits associated with reconstructive surgery. Nevertheless, nutritional autonomy is a complex outcome influenced by multiple variables beyond the surgical technique itself. Patients undergoing intestinal reconstruction may differ considerably in age,

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

underlying diagnosis, extent of previous resection, preservation of the ileocecal valve, and colonic continuity. These characteristics directly influence gastrointestinal adaptation and may affect the probability of achieving independence from parenteral nutrition. Therefore, the percentages illustrated in the figure should be interpreted as descriptive findings from published clinical evidence rather than as directly comparable measures of surgical superiority [7], [14].

The systematic review by Nagelkerke et al., which included 40 studies involving 782 pediatric patients, identified substantial variation in reported outcomes following intestinal lengthening procedures. Differences in study design, surgical indications, follow-up duration, and definitions of nutritional independence limited the possibility of establishing definitive comparative conclusions. This methodological heterogeneity is particularly important because patients undergoing STEP or LILT are not necessarily equivalent at baseline. As a result, the observed differences in rehabilitation outcomes may reflect variations in patient selection and clinical characteristics rather than differences attributable exclusively to the surgical procedures [14].

Additional evidence from Shah et al. supports the relevance of individualized surgical decision-making. Their institutional experience with autologous intestinal reconstruction demonstrated that postoperative outcomes depend on the interaction between anatomical reconstruction, residual intestinal function, and continued nutritional rehabilitation. Although surgical lengthening can improve intestinal configuration, the resulting increase in bowel length does not automatically translate into proportional improvements in nutrient absorption. Functional recovery also requires adequate intestinal motility, preserved mucosal integrity, and the capacity of the remaining gastrointestinal tract to undergo physiological adaptation [5], [16].

An important aspect of the findings is the relationship between intestinal reconstruction and the natural adaptation process following extensive bowel resection. Intestinal adaptation involves structural and functional modifications that may continue over prolonged periods, particularly in pediatric patients. Consequently, reconstructive surgery should be evaluated within the broader context of intestinal rehabilitation rather than as an isolated intervention. The potential benefits of STEP and LILT may be influenced by the degree of adaptation achieved before surgery, the presence of intestinal dilation, and the persistence of nutritional dependence despite comprehensive medical management. These considerations reinforce the importance of integrating surgical assessment with nutritional and gastroenterological evaluation [5], [6], [13].

The timing of reconstructive surgery represents another clinically relevant factor. Surgical intervention may be considered when anatomical abnormalities, particularly significant intestinal dilation and impaired transit, limit functional recovery. However, the available literature does not establish a universally applicable optimal time for intestinal lengthening procedures. Premature intervention may occur before the full adaptive potential of the remaining intestine has been established, whereas excessive delay in selected patients may prolong dependence on parenteral nutrition and exposure to its associated complications. Therefore, surgical timing requires individualized assessment based on anatomical findings, nutritional evolution, and the clinical trajectory of intestinal failure [12], [13], [15].

The findings also highlight the importance of evaluating postoperative complications and long-term outcomes. Although STEP and LILT may improve intestinal function, reconstructive procedures involve risks such as anastomotic complications, intestinal obstruction, recurrent dilation, dysmotility, and the potential need for additional surgical interventions. These complications may affect nutritional recovery and should be considered when interpreting reported rates of parenteral nutrition independence. Furthermore, differences in postoperative monitoring and access to specialized intestinal rehabilitation programs may influence the durability of surgical benefits [12], [15], [16].

From an international perspective, the available evidence supports autologous intestinal reconstruction as a valuable therapeutic option within specialized multidisciplinary programs. However, access to these procedures may vary across healthcare systems because successful implementation requires experienced surgical teams, specialized nutritional support, and prolonged postoperative follow-up. Latin American investigations have contributed additional information regarding intestinal rehabilitation and surgical management, including the experience reported by Rivera-Suazo et al. in a Mexican pediatric cohort. Although this study evaluated a different surgical approach, it illustrates the growing regional interest in reconstructive strategies for patients with complex intestinal failure [17]–[19].

Another important consideration is that complete independence from parenteral nutrition should not be the only criterion used to evaluate surgical success. Partial reductions in intravenous nutritional requirements, improved gastrointestinal tolerance, decreased intestinal losses, and greater metabolic stability may represent clinically relevant benefits even when complete autonomy is not achieved. Accordingly, future investigations should incorporate standardized definitions of functional improvement, nutritional independence, postoperative complications, and quality of life to facilitate more reliable comparisons between reconstructive techniques [1], [14], [15].

Figure 5.
Clinical Rehabilitation Outcomes in Latin America: Evidence From the RESTORE Registry

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

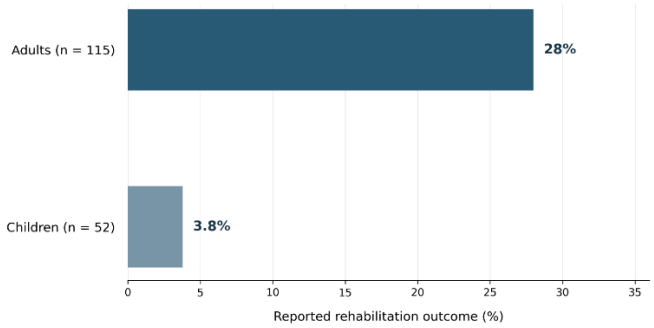

Figure 5 presents a comparative analysis of intestinal rehabilitation outcomes among adult and pediatric patients with short bowel syndrome (SBS) and associated intestinal failure in Latin America, based on findings from the RESTORE Registry. The figure illustrates reported rehabilitation rates of **28% in adults and 3.8% in pediatric patients**, highlighting differences in the achievement of functional recovery between the populations evaluated. The registry included 167 patients, comprising 115 adults and 52 children, treated across 20 specialized centers in Argentina, Mexico, Colombia, Uruguay, and Chile. These findings provide relevant regional evidence regarding intestinal rehabilitation and demonstrate the importance of examining clinical outcomes within healthcare systems that differ in resources, therapeutic accessibility, and specialized service availability [18].

The difference between the rehabilitation rates reported in adults and children represents one of the most notable observations illustrated in Figure 5. However, this variation should not be interpreted as evidence that adult patients possess a greater intrinsic capacity for intestinal adaptation. Pediatric and adult populations frequently differ in the underlying causes of intestinal failure, residual gastrointestinal anatomy, nutritional requirements, and duration of rehabilitation. In addition, pediatric intestinal adaptation may occur over prolonged periods and is influenced by intestinal growth and maturation. Consequently, the observed percentages should be understood as descriptive outcomes within the registry rather than as direct indicators of comparative physiological recovery or treatment effectiveness [3], [5], [18].

The anatomical characteristics of the included populations provide additional context for interpreting these findings. The RESTORE Registry reported a mean residual intestinal length of approximately 73 ± 55 cm among adults and 38 ± 45 cm among pediatric patients. These differences may contribute to variations in absorptive capacity and nutritional requirements, although residual bowel length alone cannot adequately predict rehabilitation outcomes. Preservation of the ileum, ileocecal valve, and colonic continuity may substantially influence fluid absorption, gastrointestinal transit, and metabolic compensation. Therefore, the relationship between intestinal anatomy and functional recovery should be evaluated through multiple physiological and clinical variables rather than a single anatomical measurement [5], [7], [18].

Another relevant factor is the duration of clinical follow-up. The registry reported a mean follow-up of approximately 22.6 ± 18.3 months among adults and 17.2 ± 5.6 months among pediatric patients. This difference may influence the proportion of patients classified as rehabilitated because intestinal adaptation and nutritional recovery can require extended periods, particularly in children with complex congenital or postoperative gastrointestinal conditions. Shorter observation periods may fail to capture patients who achieve independence from parenteral nutrition later in their clinical course. Accordingly, differences in follow-up duration represent an important limitation when interpreting the comparative outcomes illustrated in the figure [3], [6], [18].

The findings also emphasize the complexity of intestinal rehabilitation in pediatric populations. Children with SBS may require prolonged parenteral nutrition to maintain adequate growth, development, and metabolic stability. Their nutritional requirements differ from those of adults because sufficient energy and nutrient delivery must support both physiological maintenance and somatic growth. Furthermore, pediatric intestinal failure may be associated with congenital abnormalities, neonatal surgical conditions, and repeated gastrointestinal interventions. The ESPGHAN recommendations recognize these challenges and emphasize individualized nutritional rehabilitation strategies that account for developmental characteristics and the evolving functional capacity of the remaining intestine [3].

In adults, intestinal rehabilitation frequently focuses on maintaining nutritional stability, reducing intravenous supplementation, preventing complications, and improving functional independence. Nevertheless, adult patients may also present substantial challenges related to the underlying cause of intestinal resection, gastrointestinal motility disturbances, high-output intestinal losses, and complications associated with prolonged parenteral nutrition. The rehabilitation outcomes reported in the RESTORE Registry therefore reflect the interaction of multiple clinical variables rather than the isolated effectiveness of a particular therapeutic intervention [1], [4], [18].

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

The registry additionally reported mortality rates of approximately 15% among adults and 7.7% among pediatric patients during the observation period. Although mortality was not the principal outcome represented in Figure 5, these findings provide important context regarding the severity of intestinal failure and the clinical vulnerability of affected populations. Mortality in patients with chronic intestinal failure may be influenced by underlying disease, nutritional complications, infections, and associated comorbidities. However, the available registry data do not permit direct attribution of mortality differences to rehabilitation strategies or specific therapeutic interventions. These observations reinforce the importance of comprehensive clinical monitoring and prevention of complications throughout the rehabilitation process [1], [2], [18].

An important contribution of the RESTORE Registry is its multicenter design, which provides information from several Latin American countries and expands the geographical representation of intestinal rehabilitation research. Much of the international evidence concerning SBS originates from specialized centers in Europe and North America, where multidisciplinary intestinal rehabilitation programs, home parenteral nutrition services, and advanced therapeutic interventions may be more established. The incorporation of Latin American data therefore contributes to a broader understanding of intestinal failure management and highlights the importance of considering regional healthcare characteristics when interpreting international clinical recommendations [1], [17], [18].

Nevertheless, the registry primarily reflects the experiences of participating specialized institutions. Its findings may not fully represent patients treated in healthcare facilities without dedicated intestinal rehabilitation programs or those facing substantial barriers to specialized care. Differences in access to nutritional formulations, central venous catheter management, pharmacological therapies, reconstructive surgery, and long-term monitoring may influence the implementation of rehabilitation strategies. These circumstances limit the generalizability of the reported outcomes to all Latin American healthcare settings and demonstrate the need for additional population-based and multicenter investigations [17], [18].

The regional evidence can also be interpreted alongside other Latin American investigations addressing intestinal rehabilitation. Gondolesi et al. evaluated outcomes associated with comprehensive medical and surgical rehabilitation in adults with chronic intestinal failure, emphasizing the relevance of specialized multidisciplinary management. Similarly, Solar et al. investigated the use of a semisynthetic GLP-2 analogue in a referral center, contributing evidence concerning pharmacological approaches to intestinal rehabilitation. These investigations support the importance of integrating nutritional, medical, and surgical interventions according to individual clinical characteristics, although differences in study populations and methodologies prevent direct quantitative comparisons with the RESTORE Registry [17], [20].

Additional evidence from Mexico further illustrates the development of regional approaches to complex intestinal failure. Rivera-Suazo et al. described the use of an intestinal bypass technique in a pediatric cohort with SBS, contributing information regarding surgical management in a Latin American clinical setting. Although this investigation examined a different therapeutic strategy and cannot be directly compared with the registry's rehabilitation rates, it demonstrates the relevance of regional research in expanding the available evidence concerning intestinal reconstruction and functional recovery [19].

The findings presented in Figure 5 also underscore the importance of distinguishing between nutritional independence and broader clinical rehabilitation. Achievement of autonomy from parenteral nutrition represents a meaningful outcome, but successful rehabilitation should additionally consider hydration, nutritional adequacy, growth in pediatric patients, prevention of metabolic complications, and quality of life. Patients who remain dependent on partial intravenous supplementation may nevertheless experience clinically relevant improvements in gastrointestinal function and reductions in treatment burden. Consequently, standardized definitions of rehabilitation are necessary to improve the interpretation and comparability of outcomes across institutions and populations [1], [3], [18].

From a methodological perspective, the percentages illustrated in Figure 5 should be interpreted with caution because the adult and pediatric groups differed in sample size, residual intestinal length, and follow-up duration. Furthermore, the registry's observational design does not establish causal relationships between patient characteristics, therapeutic interventions, and rehabilitation outcomes. The figure therefore provides a descriptive comparison of reported clinical results rather than a controlled evaluation of treatment effectiveness. These limitations are important when integrating regional findings with international evidence derived from randomized clinical trials, systematic reviews, and specialized institutional experiences [9], [14], [18].

Future research in Latin America should prioritize the development of prospective multicenter registries with standardized definitions of intestinal failure, nutritional autonomy, and rehabilitation success. Longitudinal assessment of residual gastrointestinal anatomy, nutritional support requirements, treatment-related complications, and functional outcomes could improve the identification of factors associated with successful rehabilitation. Greater collaboration between pediatric and adult intestinal rehabilitation programs may also facilitate the evaluation of age-specific therapeutic trajectories and improve the continuity of specialized care [3], [17], [18].

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

DISCUSSION

The findings of this narrative review demonstrate that intestinal rehabilitation following extensive intestinal resection is a complex process determined by the interaction between residual gastrointestinal anatomy, physiological adaptation, nutritional support, pharmacological treatment, and surgical reconstruction. The analysis of the five figures highlights that functional recovery cannot be explained exclusively by the length of the remaining intestine or the implementation of a particular therapeutic intervention. Instead, successful rehabilitation depends on the preservation of gastrointestinal function, the development of compensatory mechanisms, and the integration of individualized treatment strategies. These observations are consistent with international recommendations emphasizing multidisciplinary management as the foundation of care for patients with short bowel syndrome (SBS) and chronic intestinal failure [1], [2], [8].

The anatomical findings presented in Figure 1 reinforce the importance of residual intestinal configuration as a major determinant of absorptive capacity and nutritional autonomy. Patients with preserved ileal and colonic continuity generally demonstrate greater potential for fluid conservation and nutrient recovery than those with an end-jejunostomy. This difference can be explained by the specialized absorptive functions of the distal ileum, the regulatory contribution of the ileocecal valve, and the capacity of the colon to recover additional energy through bacterial fermentation of unabsorbed carbohydrates. Nevertheless, the relationship between intestinal anatomy and clinical outcomes is not absolute, since adaptation also depends on intestinal motility, mucosal integrity, underlying disease, and postoperative complications. These findings support the observations of Tappenden and Le Beyec et al., who emphasized that functional adaptation involves multiple structural and physiological mechanisms rather than simple compensation for reduced intestinal length [5]–[7].

The comparison of nutritional rehabilitation strategies in Figure 2 demonstrates that parenteral, enteral, and oral nutritional interventions perform complementary functions throughout the rehabilitation process. Parenteral nutrition remains essential when gastrointestinal absorption is insufficient to maintain metabolic stability, particularly during the early stages of intestinal failure. However, prolonged dependence on intravenous supplementation introduces risks associated with catheter-related infections, thrombosis, metabolic abnormalities, and hepatobiliary complications. Consequently, the therapeutic objective should include maintaining adequate nutritional support while progressively optimizing the absorptive capacity of the remaining gastrointestinal tract. The ESPEN guidelines support this approach by emphasizing individualized nutritional prescriptions, systematic monitoring, and continuous reassessment of parenteral requirements [1], [2].

Enteral stimulation represents an important physiological component of intestinal rehabilitation because exposure to luminal nutrients contributes to epithelial adaptation and functional changes in the residual intestine. Experimental and clinical evidence indicates that intestinal adaptation involves mucosal growth, modifications in nutrient transport, and gastrointestinal hormonal responses. Nevertheless, the capacity to tolerate enteral feeding varies according to residual anatomy, intestinal transit, and the severity of gastrointestinal losses. Therefore, increased enteral or oral intake should not automatically be interpreted as improved nutritional absorption. The findings support a progressive rehabilitation model in which nutritional interventions are adjusted according to gastrointestinal tolerance, hydration status, and objective indicators of nutritional stability [4]–[6].

The pharmacological results illustrated in Figure 3 provide evidence supporting the effectiveness of teduglutide as an adjunctive treatment for SBS-associated intestinal failure. The randomized controlled trial conducted by Jeppesen et al. demonstrated that 63% of patients receiving teduglutide achieved the predefined reduction in parenteral support requirements, compared with 30% receiving placebo. This statistically significant difference indicates that GLP-2 analogue therapy can enhance intestinal absorptive function in selected patients. However, the clinical interpretation of these findings requires distinguishing between partial reduction of intravenous supplementation and complete nutritional independence. The primary outcome reflected a sustained reduction in parenteral support volume rather than definitive resolution of intestinal failure [9].

Longer-term evidence further supports the potential benefits of pharmacological enhancement of intestinal adaptation. O'Keefe et al. documented sustained reductions in parenteral support requirements during extended teduglutide treatment, suggesting that functional improvement may continue beyond the initial therapeutic period. Nevertheless,

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

treatment responses remain heterogeneous, and the available evidence does not establish that all patients will achieve complete nutritional autonomy. Anatomical characteristics, previous adaptation, underlying disease, and nutritional management may influence therapeutic outcomes. Furthermore, adverse effects, monitoring requirements, and treatment accessibility should be considered when evaluating the broader applicability of GLP-2 analogue therapy. These considerations reinforce its role as a complementary intervention within comprehensive intestinal rehabilitation rather than an independent replacement for nutritional support [10], [11].

The surgical findings presented in Figure 4 demonstrate that autologous intestinal reconstruction may provide additional opportunities for functional recovery in patients with severe anatomical limitations. Reported rates of independence from parenteral nutrition were 46% following serial transverse enteroplasty (STEP) and 52% following longitudinal intestinal lengthening and tailoring (LILT). Although these findings indicate that both procedures may contribute to improved intestinal function, the numerical difference does not establish the superiority of LILT. The systematic review by Nagelkerke et al. identified substantial heterogeneity among the included investigations, particularly regarding patient characteristics, surgical indications, follow-up duration, and outcome definitions. Consequently, direct comparisons between reconstructive techniques remain limited [14].

The physiological rationale for intestinal reconstruction involves modifying the configuration of dilated intestinal segments to improve transit and optimize the utilization of remaining absorptive tissue. Nevertheless, an increase in anatomical intestinal length does not necessarily produce a proportional improvement in nutrient absorption. Functional recovery also depends on mucosal integrity, intestinal motility, vascular preservation, and postoperative adaptation. Boroni et al. emphasized the importance of selecting reconstructive techniques according to the anatomical characteristics of the residual intestine, while Shah et al. demonstrated the variability of clinical outcomes following STEP and LILT. These findings suggest that reconstructive surgery should be considered within a broader rehabilitation framework, with continued nutritional management and long-term functional assessment remaining essential after surgical intervention [12], [13], [16].

The timing of reconstructive surgery represents an additional area of clinical uncertainty. Although intestinal lengthening procedures may be beneficial when substantial dilation and impaired transit limit rehabilitation, the optimal timing of intervention remains incompletely defined. Early reconstruction may be considered in selected anatomical circumstances, whereas other patients may benefit from continued conservative rehabilitation while spontaneous intestinal adaptation progresses. The available literature does not support a universally applicable surgical sequence, highlighting the importance of individualized evaluation and multidisciplinary decision-making. Future comparative investigations should clarify the relationship between surgical timing, residual anatomy, postoperative complications, and long-term nutritional independence [13]–[15].

The Latin American findings presented in Figure 5 contribute an important regional perspective to the interpretation of intestinal rehabilitation outcomes. The RESTORE Registry reported rehabilitation rates of 28% among adults and 3.8% among pediatric patients, demonstrating substantial differences between the populations evaluated. However, these percentages should not be interpreted as evidence of superior rehabilitation effectiveness in adults because the groups differed in residual intestinal length, underlying clinical characteristics, and follow-up duration. Pediatric patients may require prolonged nutritional rehabilitation because gastrointestinal adaptation must occur alongside growth and development. Consequently, the observed differences may partly reflect distinct rehabilitation trajectories rather than intrinsic differences in adaptive capacity [3], [18].

The regional evidence also highlights the importance of specialized intestinal rehabilitation programs. Investigations conducted in Latin American referral centers have documented the use of comprehensive medical and surgical rehabilitation, GLP-2 analogue therapy, and reconstructive procedures. These contributions demonstrate that advanced intestinal rehabilitation strategies are being implemented and evaluated within the region. Nevertheless, evidence remains concentrated in specialized institutions, potentially limiting its applicability to healthcare settings with fewer resources. Differences in access to home parenteral nutrition, specialized surgical services, pharmacological treatment, and long-term monitoring may influence rehabilitation opportunities and clinical outcomes. Strengthening regional collaboration and expanding multicenter research could improve the representativeness of available evidence [17]–[20].

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

A central implication of the reviewed findings is that nutritional autonomy should be understood as a multidimensional outcome rather than an isolated reduction in parenteral nutrition. Although complete discontinuation of intravenous supplementation represents an important therapeutic objective, partial reductions may also provide meaningful clinical benefits when accompanied by adequate hydration, nutritional stability, and fewer treatment-related complications. Similarly, improvements in gastrointestinal tolerance or intestinal transit may contribute to rehabilitation even when complete independence is not achieved. Therefore, standardized assessment should incorporate nutritional requirements, metabolic parameters, gastrointestinal function, complications, and quality of life [1], [4], [8].

The integration of nutritional, pharmacological, and surgical strategies represents one of the most important conclusions derived from the comparison of the five figures. These interventions should not be considered competing alternatives because they address different components of intestinal failure. Nutritional support maintains metabolic stability, enteral stimulation promotes physiological adaptation, teduglutide may enhance absorptive function, and reconstructive surgery can modify anatomical limitations in selected patients. Their relative contributions vary according to the stage of rehabilitation and the functional characteristics of the remaining gastrointestinal tract. This integrated interpretation is consistent with contemporary approaches emphasizing coordinated management by gastroenterology, gastrointestinal surgery, clinical nutrition, and specialized multidisciplinary teams [1]–[3], [11]–[13].

Despite these advances, several limitations affect the interpretation of the available evidence. The publications included in this narrative review encompass clinical guidelines, randomized trials, systematic reviews, observational registries, and institutional surgical experiences. Differences in study design, population characteristics, treatment indications, and follow-up duration restrict direct comparisons. In addition, the definitions of intestinal rehabilitation and nutritional independence vary among investigations, complicating the interpretation of reported outcomes. The narrative methodology also limits the ability to quantify pooled treatment effects or establish causal relationships across the different therapeutic approaches. Therefore, the findings should be understood as an integrated interpretation of published evidence rather than a formal comparative effectiveness analysis [9], [14], [18].

Future investigations should prioritize prospective multicenter studies with standardized definitions of intestinal adaptation, nutritional autonomy, and functional recovery. Additional research is necessary to identify anatomical and physiological predictors of successful rehabilitation, determine the long-term effectiveness of teduglutide, and establish clearer criteria for selecting reconstructive surgical procedures. Particular attention should also be directed toward pediatric populations and Latin American healthcare systems, where differences in developmental characteristics, therapeutic accessibility, and specialized infrastructure may influence long-term outcomes. Expanding regional clinical registries and international research collaboration could contribute to more representative evidence and improve the applicability of rehabilitation strategies across diverse clinical settings [3], [11], [17]–[20].

Overall, the findings of this review support the interpretation of short bowel syndrome as a dynamic condition in which functional recovery depends on the interaction between residual gastrointestinal anatomy, physiological adaptation, and coordinated therapeutic interventions. The evidence demonstrates that no single nutritional, pharmacological, or surgical strategy guarantees complete intestinal autonomy. Instead, the most consistent approach involves individualized multidisciplinary rehabilitation, continuous assessment of gastrointestinal function, prevention of treatment-related complications, and progressive optimization of nutritional independence. This integrated perspective provides a framework for understanding current therapeutic advances while identifying the scientific and clinical challenges that remain in the long-term management of short bowel syndrome.

CONCLUSION

Short bowel syndrome following extensive intestinal resection represents a complex clinical condition in which functional recovery depends on the interaction between residual gastrointestinal anatomy, physiological adaptation, nutritional rehabilitation, pharmacological treatment, and surgical reconstruction. The findings of this narrative review demonstrate that intestinal adaptation is a dynamic and multifactorial process that cannot be explained exclusively by the length of the remaining intestine. Preservation of ileal and colonic continuity, residual absorptive capacity, and the development of compensatory mechanisms play essential roles in determining long-term nutritional requirements and the potential for intestinal autonomy [1], [5], [7].

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

Nutritional rehabilitation remains the foundation of intestinal failure management. Parenteral nutrition provides indispensable metabolic support when gastrointestinal absorption is insufficient, while enteral stimulation and individualized oral nutritional strategies contribute to the functional adaptation of the remaining intestine. However, prolonged dependence on intravenous supplementation requires careful monitoring because of its association with infectious, thrombotic, hepatobiliary, and metabolic complications. Therefore, successful rehabilitation should prioritize adequate nutritional delivery, metabolic stability, prevention of complications, and progressive reduction of parenteral support whenever clinically feasible [1]–[4].

Pharmacological treatment with teduglutide has demonstrated significant benefits in reducing parenteral support requirements among selected patients with short bowel syndrome-associated intestinal failure. The reviewed evidence supports its capacity to enhance intestinal absorptive function through mechanisms associated with glucagon-like peptide-2 activity. Nevertheless, therapeutic responses remain heterogeneous, and reductions in intravenous supplementation do not necessarily indicate complete nutritional independence. Consequently, pharmacological enhancement should be integrated into comprehensive rehabilitation programs rather than considered an isolated therapeutic solution [9]–[11].

Autologous intestinal reconstruction techniques, particularly serial transverse enteroplasty (STEP) and longitudinal intestinal lengthening and tailoring (LILT), represent valuable alternatives for selected patients with anatomical limitations that compromise gastrointestinal function. Both procedures have demonstrated the potential to improve intestinal rehabilitation outcomes and facilitate nutritional autonomy. However, differences in patient selection, residual anatomy, surgical indications, and follow-up duration prevent definitive conclusions regarding the superiority of either technique. These findings reinforce the importance of individualized surgical assessment and continued nutritional rehabilitation following reconstruction [12]–[16].

The incorporation of Latin American evidence provides an important regional perspective on the management of intestinal failure. Findings from the RESTORE Registry and specialized rehabilitation centers demonstrate the relevance of multidisciplinary treatment while identifying differences in clinical outcomes, patient characteristics, and therapeutic accessibility. Nevertheless, regional evidence remains limited, emphasizing the need to strengthen multicenter research, standardize rehabilitation indicators, and improve access to specialized nutritional, pharmacological, and surgical interventions [17]–[20].

Despite advances in the understanding and management of short bowel syndrome, important scientific challenges remain. The heterogeneity of available studies, variability in definitions of nutritional autonomy, and limited long-term comparative evidence restrict the establishment of universally applicable therapeutic strategies. Future investigations should prioritize the identification of predictors of intestinal adaptation, evaluation of long-term pharmacological outcomes, optimization of surgical selection criteria, and development of standardized measures of functional recovery.

In conclusion, **the optimal management of short bowel syndrome requires an individualized, multidisciplinary, and continuously adjusted rehabilitation strategy that integrates gastrointestinal adaptation, nutritional support, pharmacological interventions, and reconstructive surgery when appropriate**. Therapeutic success should not be defined exclusively by the reduction or discontinuation of parenteral nutrition, but also by sustained metabolic stability, adequate nutrient absorption, prevention of complications, and improvement in quality of life. Strengthening international and Latin American scientific collaboration will be essential to advance clinical knowledge and improve long-term outcomes in patients with this challenging condition.

REFERENCES

[1] L. Pironi *et al*., “ESPEN guideline on chronic intestinal failure in adults—Update 2023,” *Clin. Nutr.*, vol. 42, no. 10, pp. 1940–2021, 2023, doi: 10.1016/j.clnu.2023.07.019.
[2] L. Pironi *et al*., “ESPEN practical guideline: Home parenteral nutrition,” *Clin. Nutr.*, vol. 42, no. 3, pp. 411–430, 2023, doi: 10.1016/j.clnu.2022.12.003.
[3] L. Norsa *et al*., “Nutrition and intestinal rehabilitation of children with short bowel syndrome: A position paper of the ESPGHAN Committee on Nutrition. Part 1: From intestinal resection to home discharge,” *J. Pediatr. Gastroenterol. Nutr.*, vol. 77, no. 2, pp. 281–297, 2023, doi: 10.1097/MPG.0000000000003849.

[4] K. Roberts, N. D. Shah, C. R. Parrish, and E. Wall, "Navigating nutrition and hydration care in the adult patient with short bowel syndrome," *Nutr. Clin. Pract.*, vol. 38, suppl. 1, pp. S59–S75, 2023, doi: 10.1002/ncp.10951.
[5] J. Le Beyec, L. Billiauws, A. Bado, F. Joly, and M. Le Gall, "Short bowel syndrome: A paradigm for intestinal adaptation to nutrition?," *Annu. Rev. Nutr.*, vol. 40, pp. 299–321, 2020, doi: 10.1146/annurev-nutr-011720-122203.
[6] K. A. Tappenden, "Intestinal adaptation following resection," *JPEN J. Parenter. Enteral Nutr.*, vol. 38, no. 1 Suppl., pp. 23S–31S, 2014, doi: 10.1177/0148607114525210.
[7] K. A. Tappenden, "Pathophysiology of short bowel syndrome: Considerations of resected and residual anatomy," *JPEN J. Parenter. Enteral Nutr.*, vol. 38, no. 1 Suppl., pp. 14S–22S, 2014, doi: 10.1177/0148607113520005.
[8] S. Massironi, F. Cavalcoli, E. Rausa, P. Invernizzi, M. Braga, and M. Vecchi, "Understanding short bowel syndrome: Current status and future perspectives," *Dig. Liver Dis.*, vol. 52, no. 3, pp. 253–261, 2020, doi: 10.1016/j.dld.2019.11.013.
[9] P. B. Jeppesen *et al*., "Teduglutide reduces need for parenteral support among patients with short bowel syndrome with intestinal failure," *Gastroenterology*, vol. 143, no. 6, pp. 1473–1481.e3, 2012, doi: 10.1053/j.gastro.2012.09.007.
[10] S. J. D. O'Keefe, P. B. Jeppesen, R. Gilroy, M. Pertkiewicz, J. P. Allard, and B. Messing, "Safety and efficacy of teduglutide after 52 weeks of treatment in patients with short bowel intestinal failure," *Clin. Gastroenterol. Hepatol.*, vol. 11, no. 7, pp. 815–823.e3, 2013, doi: 10.1016/j.cgh.2012.12.029.
[11] L. Pironi, J. P. Allard, F. Joly, P. Geransar, E. Genestin, and U.-F. Pape, "Use of teduglutide in adults with short bowel syndrome-associated intestinal failure," *Nutr. Clin. Pract.*, vol. 39, no. 1, pp. 141–153, 2024, doi: 10.1002/ncp.11015.
[12] M. J. Hommel, R. van Baren, and J. W. Haveman, "Surgical management and autologous intestinal reconstruction in short bowel syndrome," *Best Pract. Res. Clin. Gastroenterol.*, vol. 30, no. 2, pp. 263–280, 2016, doi: 10.1016/j.bpg.2016.03.006.
[13] G. Boroni, F. Parolini, M. V. Stern, C. Moglia, and D. Alberti, "Autologous intestinal reconstruction surgery in short bowel syndrome: Which, when, and why," *Front. Nutr.*, vol. 9, Art. no. 861093, 2022, doi: 10.3389/fnut.2022.861093.
[14] S. C. J. Nagelkerke *et al*., "Bowel lengthening procedures in children with short bowel syndrome: A systematic review," *Eur. J. Pediatr. Surg.*, vol. 32, no. 4, pp. 301–309, 2022, doi: 10.1055/s-0041-1725187.
[15] A. Lauro *et al*., "Serial transverse enteroplasty (STEP) in case of short bowel syndrome: Did we achieve our goal? A systematic review," *Updates Surg.*, vol. 74, no. 4, pp. 1209–1223, 2022, doi: 10.1007/s13304-022-01316-3.
[16] A. A. Shah, M. Petrosyan, A. L. Franklin, A. A. Chahine, C. Torres, and A. D. Sandler, "Autologous intestinal reconstruction: A single institution study of the serial transverse enteroplasty (STEP) and the longitudinal intestinal lengthening and tailoring (LILT)," *Pediatr. Surg. Int.*, vol. 35, no. 6, pp. 649–655, 2019, doi: 10.1007/s00383-019-04468-3.
[17] G. E. Gondolesi *et al*., "Results of surgical and medical rehabilitation for adult patients with type III intestinal failure in a comprehensive unit today: Building a new model to predict parenteral nutrition independency," *JPEN J. Parenter. Enteral Nutr.*, vol. 44, no. 4, pp. 703–713, 2020, doi: 10.1002/jpen.1686.
[18] C. Rumbo *et al*., "Short bowel syndrome related intestinal failure outcomes in Latin America: Insights from the RESTORE Registry," *JPEN J. Parenter. Enteral Nutr.*, vol. 48, no. 8, pp. 956–964, 2024, doi: 10.1002/jpen.2693.
[19] Y. Rivera-Suazo *et al*., "Usefulness and description of the intestinal bypass technique in children with short bowel syndrome: Report of a Mexican cohort," *Bol. Med. Hosp. Infant. Mex.*, vol. 81, no. 1, pp. 23–30, 2024, doi: 10.24875/BMHIM.23000110.
[20] H. Solar *et al*., "Postsurgical intestinal rehabilitation using semisynthetic glucagon-like peptide-2 analogue (sGLP-2) at a referral center: Can patients achieve parenteral nutrition and sGLP-2 independency?," *JPEN J. Parenter. Enteral Nutr.*, vol. 45, no. 5, pp. 1072–1082, 2021, doi: 10.1002/jpen.1983.

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal

Issue 4, Year 2, Volume 1, No. 02, July-December 2026
E-ISSN: 3122-3591, P-ISSN: 3122-3753
Review International Science Journal