Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
Haas et al. 2005 Switzerland Cross-sectional Level 5 N=837	**Objective:** To analyse bowel management in patients with spinal cord injury (SCI) especially the occurrence of unplanned bowel evacuations and duration of planned bowel evacuation. **Population:** 837 SCI patients (642M, 186F) from 29 rehabilitation facilities in Austria, Germany, the Netherlands and Switzerland. Injury level: 42% cervical, 45.3% thoracic, 12.7% lumbar. **Treatment:** Questionnaire **Outcome Measures:** method of evacuation, rate of incontinence, rate of bowel symptoms	1. Oral laxatives were significantly associated with increased unplanned bowel evacuations and longer episodes of bowel care (n=444; p<.001). 2. Fewer unplanned evacuations were significantly associated with manual removal and/or digital rectal stimulation (n=35; p<.05) 3. Manual evacuation associated significantly with shorter duration of bowel evacuation (<60 min) (n=64; p<.05).
Author Year; Country Score Research Design Total Sample Size	**Methods**	**Outcome**
Faaborg et al. 2014 Denmark RCT Level 1 (PEDro = 8) N=11	**Objective:** Study aimed at investigating autonomic responses to digital rectal evacuation (DE), transanal irrigation (TAI) with 500 ml and filling cystometry (FC) in SCI. **Population:** N= 8 people with SCI (AIS A) at or above T6 N= 3 people with SCI (AIS A) at T10-L2	1. The people with SCI above T6 had AD during all three examinations. 2. Systolic blood pressure (sBP) increased less during TAI (36mmHg, range 30–63) than during digital evacuation (57mmHg, range 41–75; P<0.05) or FC (61mmHg, range 55-100; p<0.02). 3. The difference in sBP between digital evacuation and FC was not significant. No participants with

	Treatment: Digital rectal evacuation, transanal irrigation (TAI), filling cystometry (FC) **Outcome Measures:** During each examination 4-week diary of daily autonomic dysreflexia (AD) episodes was completed before and after participation	SCI at T10-L2 had AD symptoms during any of the examinations
Shafik et al. 2000 Egypt Prospective Controlled Trial Level 2 N=27	**Objective:** Determine whether defecation induced by digital-rectal stimulation is mediated through a reflex mechanism. **Population:** The group of 18 healthy volunteers had a mean age of 36.6 ± 9.7 years (range 20-51). 8 were women and 10 were men. The SCI group with paraplegia were age 35.1 ± 11 .2 years; range 18- 50. **Treatment:** Anal canal dilation by inflatable balloon **Outcome Measures:** Rectal pressure measured by water-perfused 10 F catheter connected to pneumohydraulic capillary infusion system	1. Mean basal rectal pressure was not significantly different in the SCI group compared to the healthy volunteer group ($p>0.05$) 2. There was a significant increase in rectal pressure when the anal balloon was inflated to 6, 8 and 10 mL ($p<0.001$, $p<0.001$, and $p<0.001$ respectively), but no significant pressure response for 2mL and 4mL balloon inflations.
Korsten et al. 2007 USA Pre-post Level 4 N=6	**Objective:** Assess the effect of DRS on colonic motility. **Population:** Six male participants with SCI (4 with paraplegia [3 complete, 1 incomplete]; 2 with tetraplegia [1 complete, 1 incomplete); Age: mean 50.2yrs, range 44-50yrs; Level of injury: C5-T10; AIS A-C; Duration of injury: 10-29yrs. **Treatment:** Digital rectal stimulation to facilitate bowel evacuation.	1. Compared with no digital rectal stimulation (0 waves/min), the mean number of peristaltic waves/min increased during digital rectal stimulation (1.9±0.5/min) and immediately after digital rectal stimulation (1.5±0.3/min) (mean ± SEM). 2. Average amplitude of the peristaltic contractions was 43.4±2.2 mmHg (range 0.7-250 mmHg). 3. Peristaltic contractions in the left colon were accompanied

	Outcome Measures: Colorectal manometry: mean number of peristaltic waves per minute; amplitude of contractions; colonic motility.	by increased motility of the left colon and improvement in evacuation of barium as documented by fluoroscopy.
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Wincentak et al. 2021 Canada Scoping Review N=33 studies	**Objective:** To review the evidence on the use of digital rectal stimulation (DRS) for bowel management in individuals with SCI, what beneficial and adverse outcomes have been studied, and people's experiences using DRS **Methods:** Used the five stages proposed by Arksey and O'Malley for performing a scoping review. Articles that had information on the use of digital rectal stimulation alone or with a combination of treatments were included **Databases**: MEDLINE, EMBASE, CINAHL, Cochrane CENTRAL, and Cochrane Incontinence Group from 1990 to November 2019	1. Out of 34 reported outcomes found, the most reported were defecation time (n=16) and incontinence (n=15) - 12 experimental and quasi-experimental studies were found. Three studies investigated DRS as a primary intervention. 2. DRS: supplemental intervention - DRS in the remaining studies were used in combination with other interventions. - 18 observational studies were found, which studied ulcers, hemorrhoids and rectal abscess. They also primarily studied incontinence, satisfaction, QoL, constipation and abdominal pain. 3. 2 qualitive studies were found, which investigated the experience of caregivers and individuals re SCI and bowel.
Nelson & Orr et al. 2021 US Systematic Review	**Objective:** To determine evidence for digital rectal stimulation (DRS) as an intervention in the management of upper motor	1. There was moderate evidence for DRS in persons with SCI and UMN-NB. 2. There was evidence of the physiologic effect of DRS

N=11 studies	neuron neurogenic bowels (UMN-NB) in persons with spinal cord injury (SCI). **Methods:** Included research articles and practice guidelines evaluating UMN neurogenic bowel treatments and the use of DRS **Databases:** OvidMedline, PubMed and the Cochrane databases	inducing contractions for evacuating the bowel and support for combining DRS with other treatment regimens.
Author Year; Country Score Research Design Total Sample Size	**Methods**	**Outcome**
Lin et al. 2020 China Prospective controlled trial Level 2 N=46	**Objective:** To investigate alterations in fecal microbiome in people with SCI **Population:** SCI group: N=23 Female: 17.3% Age: 32 ± 2.23 years Time since injury: 11 ± 2.68 months Level: 3 cervical 12 thoracic 8 lumbar Severity: 5 complete 18 incomplete Control group: N: 23 Female: 34.8% Age: 28 ± 3.45 years **Outcome Measures:** Microbial communities in the feces of 23 patients and 23 healthy controls were investigated using high-throughput Illumina Miseq	1. People with SCI exhibited microbiome dysbiosis. While there were no significant differences in fecal microbiome alpha diversity (richness and diversity) the structure and quantity significantly differed between SCI and control group ($p<0.05$) 2. 18 operational taxonomic units (OTU) were more abundant in the control group while 27 OTUs were significantly more abundant in the SCI group.

	sequencing targeting the V3-V4 region of the 16S ribosomal RNA (rRNA) gene. The relative abundances between the fecal microbiota at the genus level in patients with SCI and healthy individuals were determined using cluster analysis.	
Gungor et al. 2016 Prospective controlled trial Level 2 N=30	**Objective**: To characterize the gut microbiota in adult SCI patients with different types of bowel dysfunction. **Population:** N=40 Level: 15 above T6 in the UMN group 15 with cauda equina syndrome in the LMN group 10 controls Severity: All patients with SCI had ASIA-A injuries UMN group: N=15 Age: 35.0 (9.5) Female: 13.3% Time since injury: 21.0(13.0–105.0) months Level: C4 (n=1, 6.7%) C5 (n=1, 6.7%) C6 (n=1, 6.7%) C7 (n=1, 6.7%) T3 (n=1, 6.7%) T4 (n=4, 26.7%) T5 (n=6, 40.0%) LMN group: N=15 Age: 34.0 (8.9) years Female: 6.7% Time since injury: 18.0(13.0–94.0) months Etiology: 46.7% motor vehicle collisions 26.7% fall 26.7% gunshot wound	1. Results demonstrate that butyrate-producing members are specifically reduced in SCI patients compared to healthy controls. 2. *Compared to the control group, Pseudobutyrivibrio*, *Dialister* and *Megamonas* genera were significantly lower in UMN group (p=0.019, p=0.042 and p=0.029 respectively, Tukey's HSD test) and *Roseburia*, *Pseudobutyrivibrio* and *Megamonas* genera were significantly lower in LMN group (p=0.019, p=0.002 and p=0.031 respectively, Tukey's HSD test) when compared to healthy controls. 3. The *Marvinbryantia* genus count was significantly lower in UMN bowel dysfunction group (p=0.021, Tukey's HSD test when compared to the LMN group.

	Level: T12 (n=5, 33.3%) L1 (n=9, 60.0%) L2 (n=1, 6.7%). Control group: Age: 34.4 (8.0) years Female: 0% **Outcome Measures:** Gut microbial patterns were determined from stool samples	
Zhang et al. 2018a China Prospective Controlled Trial Level 2 N=66	**Objective:** To document neurogenic bowel management of male patients with chronic traumatic complete SCI in the centre, perform comparative analysis of intestinal gut microbiota in male patients with chronic traumatic complete SCI versus males without SCI and explore the association between intestinal microbiota with serum biomarkers and neurogenic bowel symptoms **Population:** 43 SCI 23 non-SCI controls Female: 0% Level: 20 tetraplegia 23 paraplegia Etiology: 37.2% traffic accidents 20.9% bruised by heavy object 20.9% fall from height **Outcome Measures:** microbial diversity by stool sampling; DNA extraction and PCR amplification, Illumina MiSeq sequencing	1. Individuals with quadriplegia showed longer time to defecate, higher NBD scores and heavier neurogenic bowel. 2. Individuals with quadriplegia showed longer time to defecate, higher NBD scores and heavier neurogenic bowel symptoms than those with paraplegia. 3. Gut microbiota diversity in the SCI \group was reduced and had structurally different composition compared to those in the non-SCI adult male group. 4. In the SCI group, the abundance of Veillonellaceae and Prevotellaceae increased, while Bacteroidaceae and Bacteroides decreased. 5. The abundance of Bacteroidaceae and Bacteroides in the quadriplegia group and Acidaminococcaceae, Blautia, Porphyromonadaceae, and Lachnoclostridium in the paraplegia group were significantly higher than the control group. 6. Microbial community structure was significantly associated with serum biomarkers (GLU, HDL, CR, and CRP), NBD defecation time, and COURSE. 7. STAMP analysis showed a significant difference ($p<0.05$)

		between the constipation and non-constipation groups (Welch's t-test) in Bifidobacterium on the genus level. 8. STAMP analysis showed that Megamonas was significantly higher ($p<0.05$) in the bloating group, and Alistipes was significantly higher ($p<0.05$) in the without bloating group on the genus level.
Yu et al. 2021 China Case-control study Level 3 N=69	**Objective:** To explore the hypothesis that 1) the composition and function of gut microbiota are different among patients with complete thoracic SCI, patients with incomplete thoracic SCI and people without SCI and 2) the features of gut microbiota are correlated with the serum biomarkers and implicated in biological functions related to recovery of thoracic SCI **Population:** N=69 Level: 21 Complete thoracic SCI 24 Incomplete thoracic SCI 24 Healthy Etiology: 18 motor vehicle collisions 12 fall from elevated height 7 bruised by heavy object Time since injury: 5.64 ± 2.52 months **Outcome Measures:** NBD score was used to evaluate bowel function for those with SCI. The alpha diversity was determined based on four indices, including observed OTUs (a measure of species richness),	1. For the SCI group, there was reduced diversity of the gut microbiota, and alpha diversity had decreased gradually with an increase in the degree of damage. 2. Gut microbiota in the SCI group was distinct from non-SCI participants. 3. CTSCI group exhibited further deviation in gut microbiota composition than the ITSCI group compared to healthy individuals. 4. Four serum biomarkers were found to be correlated with most differential genera. 5. SCI accounted for 9.8% (*adnois* $P<0.001$) of the gut microbiota variance at the genus level, while the effect size was higher than that observed for other individual. characteristic features, including sex, age, BMI, and clinical serum biomarkers.

	Shannon index (a measure of species richness and species evenness), Faith's phylogenetic diversity (a measure of species richness), and Pielou's evenness.	
Kim et al. 2016a South Korea Pre-post Level 4 N=31	**Objective:** To investigate the effects and safety of the aqueous extract of the dried, immature fruit of *Poncirus trifoliata* (L.) Raf., known as *Poncirus fructus* (PF), in spinal cord injury (SCI) patients with neurogenic bowel. **Population:** N=31 SCI patients with neurogenic bowel (25 were included) Age: 50.9±17.3 years, Range 18-88 years Level: 14 cervical, 11 thoracolumbar, 5 AIS A, 5 AIS B, 4 AIS C, 11 AIS D Etiology: 19 traumatic, 1 transverse myelitis, 5 other Duration of injury: 5.3±6.0 months % Female: 3 females (12%) **Intervention:** Poncirus fructus (PF) administered in dosages of 800 mg each prior to breakfast and lunch for 14 days. **Outcome Measures:** Bowel outcomes before and after administration of PF for 2 weeks. Survey of defecation patterns, plain abdominal radiography, colonic transit times, and side effects	1. Significant decrease in mean (SD) constipation score (4.60±3.35 to 3.48±2.42) (p=0.04). 2. The Bristol stool scores before and after administration were significantly different (3.52 ± 1.33 to 4.32 ± 1.44 points) (p=0.03). 3. Stool retention score before and after administration of PF was represented with low significance (7.25 +/- 1.60 – 6.46 +/- 1.53 points) in the whole colon ($p < 0.05$). 4. Colon transit time was significantly in terms of the whole transit time shortened (57.41 ± 20.7 to 41.2 ± 25.5 hours), in right colon (14.4±16.2 to 10.1±12.1h), and in left colon (21.8±12.3 to 14.8±11.8h) ($p<0.05$). 5. Side effects were observed in 7 people (28.0%) consisting of 2 people with soft stools and 5 people with diarrhea.
Cameron et al. 1996 Australia Case Series Level 4	**Objective:** Assess the nutrient intake of SCI patients, to determine baseline transit time, stool weight and evacuation time	1. Following the addition of bran, dietary fibre intake significantly increased from 25g/d to 31g/d.

N=11	and to assess the effect of addition of bran on large bowel function **Population:** Age: range 19-53yrs; Level of injury: C4-T12; 1 participant with incomplete injury and 10 with complete injuries; 7 participants with tetraplegia and 4 with paraplegia. All participants were in their first rehabilitation program 1-4 months after injury. **Treatment:** In phase 1 (week 1), participants ate a normal hospital diet and maintained their bowel routine. In phase 2 (week 2-4), fibre intake was increased with the addition of 40g Kellogg's All Bran. **Outcome Measures:** stool weight, total and segmental transit time, bowel evacuation time and dietary intake.	2. Mean colonic transit time significantly lengthened from 28.2 hours to 42.2 hours.
Author Year; Country Score Research Design Total Sample Size	**Methods**	**Outcome**
Borsh et al. 2019 USA Cohort Level 2 N=52	**Objective**: To establish a neurogenic bowel program after SCI in the acute care setting, examine clinician knowledge and ability to deliver the NB program, and evaluate patient knowledge satisfaction and QOL **Population:** N=52 Age at injury: mean 39.3 ± 17.4 y 37% paraplegia 63% tetraplegia Level -	1. 77 nurses/patient care technicians and 19 PTs and OTs completed the post-education survey, which reported that knowledge of CPGs improved for all questions after the education in-service. 2. Patient knowledge increased significantly from pre-education to post-education including understanding what a SCI is (p=0.02), level of injury (p=0.016), use of suppositories (p=0.008), and digital stimulation (p=0.001).

	62% cervical 27% thoracic 12% lumbar 40% ASIA A 10% ASIA B 25% ASIA C 13% ASIA D 2% ASIA E 10% unknown **Outcome Measures:** Pre- and post-education surveys were given to health care providers and patients to measure change in knowledge of NB. Patient survey also included satisfaction and quality of life questions related to health, pain, and self-care taken from the Quality of Life Index-SCI version III. Demographic information, injury characteristics, and bowel medication lists which were extracted from the medical record.	
Cabigon et al. 2019 USA Cross-sectional Level 5 N=27	**Objective**: The aim of the study was to illustrate how interprofessional collaboration led to utilizing resources of the inpatient rehabilitation facility's peer mentor program and incorporating peer mentors into bowel education for persons with SCI. **Population:** People with SCI who have issues with bowel management N=27 out of 28 responded to the survey **Outcome Measures:** 8-item Likert scale evaluation survey with three open-ended	1. Results showed that the education program was useful, should be continued, and include the peer mentors. 2. Responses from open-ended questions included themes related to knowledge, adherence, and taking charge of one's own care. Interprofessional collaboration and involvement of peer mentors as co-presenters in SCI bowel education were feasible. 3. Majority of individuals reported it helped them understand the importance of following a program.

	questions to assess the utility of incorporating peer mentors into bowel education	