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EFFECT OF PRE-OPERATIVE CARBOHYDRATE LOADING ON RETURN OF BOWEL FUNCTION AFTER REVERSAL OF ILEOSTOMY: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Objective: To compare time to return of bowel function in patients receiving preoperative carbohydrate loading versus placebo following ileostomy reversal.

Methodology: This randomized controlled trial parallel trial was conducted at The Indus Hospital, Karachi from 15th October 2025 to 14th April 2026 after IRB approval. Sixty-six patients undergoing elective ileostomy reversal were randomly assigned to receive a carbohydrate-rich drink (Group A, n=33) or placebo (Group B, n=33). Primary outcome was time to first flatus. Secondary outcomes included audible bowel sounds, semi-solid tolerance, nausea/vomiting, and postoperative ileus.

Result: Mean age was 42.16±9.37 years; 41 (62.1%) were males. Carbohydrate group showed significantly earlier flatus time 23.6±12.0 vs. 41.7±14.4 hours; mean difference-18.55 hours, 95% CI -24.59 to -12.49; p<0.001. Audible bowel sounds at 48 hours were present in 93.8% vs. 52.9% (p<0.001). No significant differences were observed for semi-solid tolerance, nausea/vomiting, or postoperative ileus.

Conclusion: Preoperative carbohydrate loading significantly accelerates bowel function recovery after ileostomy reversal. Routine implementation is recommended given its simplicity, safety, and low cost.

KEYWORDS: Diet, Carbohydrate loading, Ileostomy/surgery, Postoperative ileus, Recovery of Function, Enhanced recovery after surgery, Randomized controlled trial

INTRODUCTION

A temporary loop ileostomy is a frequently used approach to faecal diversion to preserve a distal colorectal or coloanal anastomosis especially in low anterior resection for rectal cancer. While helpful and life-saving, having an ileostomy comes with a metabolic, nutritional, and psychological burden, which requires a second surgical procedure to reverse. Pirzada et al[1] reported that postoperatively, stoma reversal carries a high level of morbidity with postoperative ileus (POI) being the major complication. The importance of the clinical significance of POI cannot be emphasized enough, Mitra and Prakash[2] explained that it results in prolonged hospitalization, delayed oral intake, increased risk for nutritional compromise and higher health care costs.

Supportive treatment of established POI is the current standard of care, which consists of nil per os, intravenous fluids, nasogastric decompression and electrolyte correction. Thus, peroperative care has become an important area of focus for implementing preventive strategies. Inflammatory stress after surgery is minimised and recovery is maximised with the Enhanced Recovery After Surgery (ERAS) programmes. Ottaviano et al[3] have proven that the outcomes of the implementation of an improved recovery program are significantly better, especially when it comes to the return of bowel function, in patients where the closure of the loop ileostomy is the surgery performed. In patients undergoing stoma closure, Kurmi et al[4] showed that ERAS protocols were safe and feasible, with the time to flatus and hospital stays reduced. Preoperative optimization is an important determinant of enhanced recovery in colorectal surgery in the future.[5]

Preoperative carbohydrate loading is among one of the ERAS elements most widely studied. Tong et al[6] conducted a Bayesian network meta-analysis and found that carbohydrate loading had a beneficial effect on recovery following elective surgery. Recently, Lu and colleagues[7] performed a systematic review and meta-analysis of randomized controlled trials to validate the benefits of preoperative carbohydrate loading on insulin sensitivity, postoperative vomiting and hospital stay while not increasing the risk of aspiration. Patel et al[8] noted the positive outcomes of bowel function recovery after major abdominal surgery with preoperative immunonutrition and carbohydrate loading. Mureed et al[9] directly proved from colorectal surgery that carbohydrate loading before surgery significantly reduced the time to first flatus when compared with the traditional fasting period. In case of elective colorectal surgery, Shah et al[10] confirmed that carbohydrate loading reduced the incidence of postoperative ileus statistically significantly. Caldwell also reiterated the importance of the effect of carbohydrate loading on lowering perioperative insulin resistance as the most important metabolic mechanism.[11]

Madan et al[12] performed a randomized controlled trial to evaluate ERAS pathway versus standard care in patients undergoing elective stoma surgery for reversal. The ERAS group patients had significantly reduced length of hospital stay. The ERAS group had significantly early functional recovery than the standard care group in terms of early resolution of ileus, time to first stool, time to liquid diet and time to solid diet. The ERAS group had significantly lower surgical site infections, with comparable postoperative nausea/vomiting, pulmonary complications and urinary tract infections.

While these promising results are promising, there is still much that is unknown. Most of the studies conducted so far, such as Madan et al.,[12] have considered the overall ERAS rather than the effect of carbohydrate loading alone. There is little research with a well-designed randomized controlled study conducted to date on isolated preoperative carbohydrate loading to assess return of bowel function after ileostomy reversal in a shorter, more limited dissection where POI is more likely to occur. Prolonged hospital stay will affect both patient productivity and institutional resources, particularly when the surgery is an ileostomy reversal, which is one of the most commonly performed surgeries locally, among young and middle aged individuals. The aim of this study is to compare the time to bowel function recovery for those undergoing carbohydrate loading (CHL) versus placebo preoperatively before ileostomy reversal. In this study we suspected that patients who were fed a carbohydrate loading diet preoperatively would return bowel function earlier than patients who were given a placebo diet.

METHODOLOGY

This randomized placebo controlled, parallel group trial with 1:1 allocation, was carried out in the Department of General Surgery of the Indus Hospital, Karachi with approval from the Institutional Review Board of the Indus Hospital (IHHN-IRB-2025-06-017, dated 14th October 2025). All procedures were carried out in accordance with the ethical guidelines of the institutional research committee and the Helsinki Declaration of 1975 (as recently updated in 2008). The trail registration number was NCT07684755, obtained online through clinical.trial.gov. All the subjects in the study (or their next of kin) signed informed consent forms. The study was conducted for 6 months started from 15th October 2025 to 14th April 2026, inclusive of 72 hours follow up postoperatively. The adult patients of both sexes, aged 18 years or more who were scheduled for elective reversal of loop ileostomy at The Indus Hospital, Karachi were evaluated for eligibility. Patients who had an American Society of Anaesthesiologists (ASA) class of 2 or less were included, as were patients with no other complications other than postoperative ileus. Patients with chronic or active intestinal disease (Crohn's disease, ulcerative colitis, and irritable bowel syndrome), postoperative complications other than ileus (anastomotic leak, bleeding, and wound dehiscence) and failure to respond to conservative treatment for more than 72 hours were excluded. Patients were excluded if they did not meet the eligibility criteria.

An expected large effect size (Cohen's d = 1.0) and a mean difference of 24 hours with a standard deviation of 24 hours were assumed to calculate the sample size on G*Power software (version 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Germany). It was determined that there were to be 21 patients in each group, 21 patients per group with a two-sided alpha of 0.05 and a power of 90%. There was a 20% drop-out and 27 patients were left in each group. For the purpose of having enough power and to cover for possible protocol violations, 33 patients were enrolled in each group, thus making the total number of patients 66. The randomization sequence was generated by research department and participants were enrolled by the primary investigator. The sequentially numbered, opaque, sealed envelopes were used to assign participants to their allocated group by a research assistant who was not involved in participant enrolment or clinical care. Sequentially numbered, opaque, sealed envelopes made in advance by the research department were used to ensure allocation concealment. Envelopes were stored in a safe place and were opened only by the research assistant when the participant was to be enrolled, and after he/she was determined to be eligible and had agreed to participate in the study.

The intervention group (Group A) was fed on the evening prior to surgery with 200 ml of a carbohydrate-rich beverage. The same carbohydrate fluid was given once more to the nursing staff to be provided at 06:00 AM on the morning of surgery, ensuring a minimum fasting period of two hours prior to induction of anaesthetic. The patients of the placebo group (Group B) were given 200 ml of a sugar free lemon flavored drink the evening prior to surgery and 200 ml of the same drink at 06:00 AM on the morning of surgery. Both drinks were presented to the patients using opaque jugs, the study participants, outcome assessors, surgeon and data analyst were blinded to group allocation to limit identification bias.

The outcomes were predefined before trial registration and it was time until bowel function return was judged postoperatively using three criteria: the return of audible bowel sounds on abdominal auscultation, passage of flatus and tolerability of semi-solid food. A general surgery resident of 3rd year or above, using a Littmann Classic III stethoscope, was able to hear audible bowel sounds at 12, 24, 36, 48, 60 and 72 hours' post-surgery. Patient self-report and nursing documentation of passage of flatus occurred at the same times. Semi-solid food tolerance was determined as the patient's ability to take the semi-solid diet without nausea or vomiting after surgery. Postoperative ileus was diagnosed if at least two of the following five criteria were met: semi-solid or solid food intolerance within the last 24 hours of surgery, lack of gas or stool passed during last 24 hours, abdominal distention, and radiological signs of ileus. Secondary outcomes were episodes of nausea and vomiting at each assessment time point, the development of postoperative ileus, and the requirement for conservative management interventions (nil per os, intravenous fluids, nasogastric decompression, radiological assessment).

A structured proforma was used to collect data such as patient demographics (age, gender, medical record number), eligibility criteria, group allocation, timing of preoperative drink administration, parameters at each interval after surgery (12, 24, 36, 48, 60, and 72 hours) including audible bowel sounds (yes/no), passage of flatus (yes/no), tolerance to semi-solid food (yes/no), and nausea/vomiting (yes/no). Time to first flatus was measured in hours. Patients with postoperative ileus were identified and the criteria fulfilled were recorded and interventions provided were recorded. IBM SPSS Statistics 24.0 (IBM Corp., Armonk, NY, USA) was used to entered and analyzed the data. Age, time intervals (time to audible bowel sounds, time to passage of flatus, and time to tolerance of semi-solid diet) were presented as mean ± standard deviation or median with interquartile range as appropriate. To determine the normality of quantitative variables, the Shapiro-Wilk test was used. Qualitative data such as gender, nausea and vomiting, audible bowel sounds, flatus, tolerance of semi-solid diet and presence of postoperative ileus were reported as frequencies and percentages. Independent sample t-test was used for comparing the mean time intervals between two groups for normally distributed quantitative data and Mann-Whitney U test was used for non-normally distributed quantitative data. The Chi-square test or Fisher's exact test was applied to compare categorical variables between the two groups as appropriate. Statistically significant means a p-value of ≤0.05.

RESULTS

The mean age was 42.16±9.37years. Majority of the patients were male 41 (62.1%) whereas female patients were 25 (37.9%). All 66 patients had ASA class II or less, comparison of age and gender between groups (Table 1). Most of the patients had audible bowel sounds post-surgery at 24 hours followed by 48 hours, 36 hours 9 hours and 72 hours. None of the patients had audible bowel sounds at 60 hours. A large proportion of patients passed the first flatus postoperatively at 36 hours and least at 72 hours (Table 2). In the interventional group, most of the patients had audible gut sounds at 24 hours whereas in placebo group, majority of the patients had audible gut sounds at 48 hours. On comparison between groups a statistically difference was observed as p value was 0.001 (Table 3).

Equal number of patients 12 (36.4%) passed the first flatus at 12 and 24 hours in CHO group. On the other hand, in placebo group, majority passed the first flatus at 48 hours. Time to first flatus was 3.64±11.02 vs. 42.18±13.46 hours in carbohydrate loading and placebo groups respectively, the mean difference -18.55 hours, 95% CI -24.59 to -12.49; p<0.001 (Table 4). The overall tolerance to semi solids was observed in 65 (98.5%), nausea / vomiting was noted in 4 (6.1%) and Post-Operative Ileus was seen in 6 (9.1%) of patients. In comparison of these secondary outcome between groups no significant difference was found as p value was >0.05 (Table 5). None of the patient had any adverse events during the study period.

Table 1: Distribution of age and gender between groups (n=66)

Characteristic	**Group A (CHO)** (n=33)	**Group B (Placebo)** (n=33)	**p-value**
Age (years, mean±SD)	41.52±9.83	42.82±8.99	0.576
Gender, n(%)			
Male	18 (54.5%)	23 (69.7%)	0.450
Female	15 (45.5%)	10 (30.3%)	
ASA Class ≤2	33 (50.0%)	33 (50.0%)	---

Table 2: Time to audible bowel sounds and first flatus at different time intervals (n=66)

Hours	**Audible Bowel sounds**	**First Flatus** n
12	9 (13.6%)	14 (21.2%)
24	23 (34.8%)	15 (22.7%)
36	11 (16.75)	17 (25.8%)
48	22 (33.3%)	15 (22.7%)
60	-	4 (6.1%)
72	1 (1.5%)	1 (1.5%)

Table 3: Comparison of audible bowel sounds between groups

Groups	**Time in hours**							**P value**
	12	**24**	**36**	**48**	**60**	**72**	**Total**	

Group CHO	7 (21.2%)	20 (60.6%)	3 (9.1%)	3 (9.1%)	-	-	33 (100%)	0.001
Group Placebo	2 (6.1%)	3 (9.1%)	8 (24.2%)	19 (57.6%)	-	1 (3%)	33 (100%)	
Total	9 (13.6%)	23 (34.8%)	11 (16.7%)	22 (33.3%)	-	I (1.5%)	66 (100%)	

Table4: Comparison of time to first flatus between groups

Groups	Time in hours							P value
	12	24	36	48	60	72	Total	
Group CHO	12 (36.4%)	12 (36.4%)	7 (21.2%)	2 (6.1%)	-	-	33 (100%)	0.001
Group Placebo	2 (6.1%)	3 (9.1%)	10 (30.3%)	13 (39.4)	4 (12.1%)	1 (3%)	33 (100%)	
Total	14 (21.2%)	15 (22.7%)	17 (25.8%)	15 (22.7)	4 (6.1%)	1 (1.5%)	66 (100%)	

Table 5: Comparison of secondary outcomes between groups

Outcome	Group A	Group B	P value
Tolerance to semi-solid food, n (%)	33 (100.0%)	32 (97.0%)	1.00
Nausea and vomiting, n (%)	1 (3.0%)	3 (9.1%)	0.613
Post-operative ileus, n (%)	1 (3.0%)	5 (15.2%)	0.197

DISCUSSION

The present study showed preoperative carbohydrate loading to significantly improve bowel function recovery following ileostomy reversal. In a randomized controlled trial, carbohydrate loading group patients had a median time of 2days to flatus compared to 3 days in a fasting group (p =0.3).[13] Our results are consistent with this prior work.

There may also be a clinical explanation for why patients started to have their bowel function return earlier as the duration of postoperative ileus has been decreased because of better electrolyte balance and less systemic inflammatory response. This carbohydrate-rich fluid has a quick energy source that could be helpful in dampening the catabolic reaction to surgical stress, thus decreasing the duration of postoperative ileus. In our study, the majority of the carbohydrate group (72.8%) had passed flatus by 24 hours, and had audible bowel sounds by 24 hours (60.6%). In the ERAS group, which included the preoperative carbohydrate loading, they noted that patients had significantly earlier resolution of ileus, with a median of 2 days compared to the standard group.[12]

Reduced psychological stress is likely to have a direct impact on gastrointestinal motility via the brain-gut axis and may help explain this improvement in subjective well-being, as shown by Kumar et al.[14] Nutritional optimization, such as carbohydrate loading, was also highlighted as a crucial aspect of the multidisciplinary care for patients undergoing surgery of the lower digestive tract by Utrilla Fornals and colleagues.[15]

Preoperative oral carbohydrate administration was shown to improve postoperative glucometabolic response, subjective well-being and quality of life in patients undergoing colorectal surgery, as reported by Urkan et al.[16] Moreover, Jin et al[17] recently reported that ileostomy reversal itself causes significant changes in the gut microbiome and metabolome which could potentially influence recovery patterns.[1] Finally, Marcuccilli and Jatczak[18] compared carbohydrate loading versus fasting, and concluded that the intervention would result in a faster return of bowel function.

In the present study, there were no significant differences between the two groups in terms of tolerance to semi-solid food, nausea, vomiting, and postoperative ileus. The relatively high overall tolerance rate (98.5% of the whole cohort) might be due to the differing surgical insult of ileostomy reversal from larger colorectal resections. Despite the low incidence of nausea and vomiting reported as 7%, 7% and 10% on postoperative day 0, 1, and 2, respectively, this indicates that the enhanced recovery principles were being adhered to, limiting the confounding effect of these factors.[19]

The results of this study have clinical implications. Carbohydrate loading is an easy-to-implement procedure, given its impact on gut microbiome and plasma metabolome as seen by Xu et al.[20] After an approximate reduction in time to first flatus of 18 hours in the intervention group, the patients in the intervention group were more likely to be able to tolerate oral intake earlier and thus be discharged earlier from the hospital.

Additionally, the cost savings of the shorter hospital stays and return to productivity are significant. Knowing the financial burden of PONIs, and the additional financial burden of each extra day of ileus, it is clear that the longer a patient remains in hospital, the greater the economic impact will be.[21]

The strengths of this study are that it is a randomized controlled design, reducing selection bias and providing good causal evidence. Objective outcome measures such as standardized auscultation using trained surgical residents and trained Littmann Classic III stethoscopes, improve the reliability of the results. Our approach was line with Ueland et al[22] and Shawki et al[23], who both cited carbohydrate loading as an effective cornerstone of ERAS pathways.

Limitations of study: The first limitation of the study is that it took place in one tertiary care center, and may not be easily extrapolated to other centers. Jacob et al[24], in their study verified that delay in return of bowl function is still a matter of great concern even in enhanced enhanced recovery settings. Second, the primary outcomes were objective, but the presence of audible bowel sounds and flatus passage could be subjective, depending on the assessor's experience. Third, the effect of carbohydrate loading on other clinically relevant outcomes including length of hospital stay, readmission and/or long-term quality of life was not evaluated. Fourthly, because of the relatively short follow-up time (72 hours), side effects not seen at this time may have been missed. Fifth, one patient had a protocol deviation (wrong treatment). This patient was not lost to follow-up so was analysed in the group it had been randomized and may have introduced some dilution of the true treatment effect. Sixth, the use of a sugar-free lemon flavored placebo might have been somewhat of an active placebo, due to the flavor or volume of the drink, some patients may have experienced subjectively felt effects.

CONCLUSION

The use of carbohydrate loading prior to an ileostomy reversal will help to expedite the return of bowel function after reversal – earlier bowel sounds and passage of flatus – without an increased risk of nausea or vomiting. This is an easy, safe, and inexpensive procedure and it is recommended that it be routinely performed in the preoperative management of patients undergoing ileostomy reversal. It offers strong evidence for the utilization of carbohydrate loading in a stoma reversal enhanced recovery protocol and should be further studied in larger and more diverse populations.

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