Journal of Rare Cardiovascular Diseases
ISSN: 2299-3711 (Print) | e-ISSN: 2300-5505 (Online)
www.jrcd.eu
RESEARCH ARTICLE

# Preoperative Carbohydrate- Rich Drink to Enhance Recovery in Non-Diabetic Surgical Patients: A Prospective Observational Study from India

**Dr. Ajay Ramesh[1] and Dr Shruthi Kamal[2]**
[1]Surgery Resident, Saveetha Medical College and Hospital, Chennai, Tamil Nadu, India 602 105.
[2]Department of General Surgery, Saveetha Medical College and Hospital, Saveetha University, Chennai, Tamil Nadu, India 602 105.

*Corresponding Author
Dr. Ajay Ramesh

Article History
**Received:** 21.09.2025
**Revised:** 30.09.2025
**Accepted:** 22.10.2025
**Published:** 11.11.2025

Abstract: ***Background***: Prolonged preoperative fasting is a long-standing convention intended to reduce aspiration risk but contributes to glycogen depletion, insulin resistance, hyperglycemia, and catabolic stress. Enhanced Recovery After Surgery (ERAS) pathways endorse consumption of carbohydrate-containing clear fluids up to 2 hours before anesthesia to mitigate these adverse effects. The safety and impact on clinical recovery endpoints in Indian surgical populations remain underexplored. ***Objective***: To evaluate the efficacy and safety of a 400 mL carbohydrate-rich drink (CRD) administered 2 hours preoperatively in non-diabetic adults undergoing elective abdominal or limb surgery, focusing on postoperative nausea/vomiting (PONV), return of gastrointestinal function, glycemic control, complications, and patient satisfaction. ***Methods***: In this prospective observational study (Jan–Dec 2024), 128 non-diabetic patients (age >18 years, ASA I–II) were allocated to either the control group (standard fasting) or intervention group (400 mL CRD 2 hours before surgery), with 64 patients in each group. Primary outcomes were incidence of PONV, time to return of bowel function, and patient satisfaction. Secondary outcomes included day-1 glucose levels, pain/discomfort (days 1–3), initiation of enteral feeding, early ambulation, complications including surgical site infection (SSI), length of hospital stay, and any aspiration/regurgitation events. Continuous data were compared using Student's t-test and categorical data with Chi-square test. A two-sided $p<0.05$ denoted statistical significance. ***Results***: The study groups were comparable at baseline in age, BMI, ASA grade, comorbidities, and surgical categories. The CRD group had a significantly lower incidence of PONV (7.8% vs 31.3%, $p<0.001$) and faster return of bowel function by day 2 (92% vs 72%, $p=0.0028$). Mean day-1 glucose was significantly lower in the CRD group ($114.1 \pm 11.2$ vs $133.6 \pm 15.0$ mg/dL, $p<0.001$). Patient satisfaction (good/excellent) favored CRD ($p=0.0002$). No aspiration or regurgitation events occurred. Differences in pain/discomfort, SSI, and length of stay did not reach statistical significance, though trends favored the CRD arm. ***Conclusion***: Preoperative ingestion of a carbohydrate-rich drink 2 hours before anesthesia is safe and beneficial in non-diabetic patients, reducing PONV, improving glycemic control, and accelerating return of bowel function. These findings support incorporation of CRD into ERAS protocols in eligible patients and align with evolving ASA and ERAS/ESPEN guidance.

Keywords: Preoperative fasting, carbohydrate loading, ERAS, PONV, insulin resistance, gastrointestinal recovery.

## INTRODUCTION

Traditional "nothing by mouth after midnight" (NPO) protocols persist globally, despite accumulating evidence that prolonged fasting may exacerbate the physiological stress response to surgery. Extended fasting promotes glycogen depletion, enhanced insulin resistance, protein catabolism, and postoperative hyperglycemia, thereby impairing wound healing, augmenting infection risk, and delaying recovery. Enhanced Recovery After Surgery (ERAS) frameworks aim to counteract these deleterious changes via multimodal interventions, among which preoperative carbohydrate loading is a core element.

In 2023, the American Society of Anesthesiologists issued a modular update to its preoperative fasting guidelines, explicitly endorsing the ingestion of carbohydrate-containing clear fluids (approximately 300–400 mL) up to 2 hours before anesthesia in healthy adults without elevated aspiration risk. These recommendations reflect a paradigm shift from rigid fasting to physiologically guided, evidence-informed preoperative hydration and nutrition. Numerous meta-analyses and randomized trials have further examined the impacts of carbohydrate loading, with varying degrees of reported benefit on insulin sensitivity, discomfort, PONV, and length of stay.

However, heterogeneity persists in results, particularly in clinical endpoints (e.g., length of stay, complications). Some syntheses suggest modest reductions in hospital stay and symptomatic endpoints, whereas others report neutral effects or procedure-specific variation. Given such mixed evidence and the scarcity of Indian trials, our study adds pragmatic, real-world data on CRD use in non-diabetic surgical patients in India, focusing on symptomatic recovery, metabolic outcomes, and safety.

## MATERIALS AND METHODS

Study design and setting: Prospective, observational study conducted at Saveetha Medical College & Hospital, Chennai, from January to December 2024.

Ethical approval was obtained from the Institutional Ethics Committee, and all participants gave written informed consent.

Inclusion and exclusion criteria: Inclusion criteria were adults (>18 years), ASA physical status I–II, non-diabetic status, and elective abdominal or limb surgery under general or regional anesthesia. Exclusion criteria comprised diagnosed diabetes, pregnancy or lactation, significant cardiac or hepatic dysfunction, known gastroparesis or high aspiration risk, and incomplete data or withdrawal.

Intervention: The control group followed conventional fasting (no solids after midnight, clear liquids restricted as per routine). The intervention group received a 400 mL carbohydrate-rich clear beverage (Electro-Serve™, glucose/maltodextrin-based) consumed approximately 2 hours prior to anesthesia induction. Other perioperative care (anesthesia, analgesia, fluid therapy, antiemetics, mobilization) followed institutional standards.

Outcome measures: Primary outcomes were (1) PONV incidence on postoperative day 1, (2) return of bowel function by days 2–3, and (3) patient satisfaction (poor/average/good/excellent). Secondary outcomes included day-1 capillary glucose, pain (VAS) and discomfort on days 1–3, initiation of enteral feeding, ambulation by days 2–3, complications including SSI, length of hospital stay, and any aspiration/regurgitation events.

Statistical analysis: Continuous variables are presented as mean ± standard deviation (SD) and compared with two-sided Student's t-tests. Categorical variables are reported as counts (percentages) and compared with Chi-square or Fisher's exact tests. A p value <0.05 indicated statistical significance.

# RESULTS

Baseline characteristics: The cohorts were well-balanced at baseline. Mean age was 38.7 ± 10.2 years in control versus 39.6 ± 9.8 years in the CRD group (p=0.64). BMI, ASA grade, comorbidities, and proportions of abdominal versus limb procedures did not differ significantly (all p>0.3), supporting internal comparability.

Primary outcomes: PONV incidence on day 1 was significantly lower in the CRD group (5/64; 7.8%) than controls (20/64; 31.3%) ($\chi^2$=11.18, p=0.0008). Return of bowel function by day 2 favored CRD (59/64; 92%) compared with control (46/64; 72%) ($\chi^2$=8.96, p=0.0028). Patient satisfaction ratings were also superior in the intervention arm, with a higher proportion reporting "good" or "excellent" (p=0.0002).

Secondary outcomes: Mean postoperative day-1 glucose was significantly lower in the CRD group (114.1 ± 11.2 mg/dL) compared with controls (133.6 ± 15.0 mg/dL) (p<0.001), suggesting attenuation of perioperative insulin resistance. Five patients (7.8%) in the control group experienced minor postoperative morbidity (e.g., wound issues, transient ileus) versus none in the CRD group (Fisher's exact p=0.0225). Initiation of enteral feeding by postoperative day 2 occurred more frequently in the CRD group (59/64; 92.2%) than controls (47/64; 73.4%) (p=0.0049). Pain/discomfort scores were lower in CRD but not statistically different at days 1–3. Early ambulation (days 2–3) was more common in the CRD arm, though this difference did not reach significance. Mean length of stay trended shorter with CRD (4.25 ± 0.95 vs 4.55 ± 1.02 days; p=0.116). No aspiration or regurgitation events occurred in either group

# DISCUSSION

This pragmatic, single-center study indicates that preoperative carbohydrate loading (400 mL, 2 hours before anesthesia) is safe and confers clinically relevant advantages in non-diabetic adults undergoing elective surgery. The reduction in PONV and earlier gastrointestinal recovery are consistent with the metabolic rationale for carbohydrate loading and echo findings from international ERAS literature. The significantly lower day-1 glucose in the CRD arm supports attenuation of surgery-related insulin resistance, which is associated with better wound healing and fewer infectious complications in broader perioperative research.

Context with current guidance: Contemporary ASA guidance endorses carbohydrate-containing clear liquids up to 2 hours preoperatively in appropriately selected adults, reflecting a strong safety signal and physiologic benefit. ESPEN/ERAS guidelines similarly recommend preoperative carbohydrates as part of multimodal optimization, with caveats for patients at elevated aspiration risk or with gastroparesis. Our absence of aspiration events and favorable recovery metrics reinforce the appropriateness of this strategy in non-diabetic, low-risk patients.

Evidence synthesis: Systematic reviews and meta-analyses collectively suggest that carbohydrate loading reduces insulin resistance and improves patient-reported comfort, with procedure-dependent effects on length of stay and complications. Some analyses show a modest reduction in length of stay (~0.5 days), whereas others show neutral effects; heterogeneity in dose, timing, and surgical type likely contributes. Our nonsignificant trend toward shorter stay aligns with these pooled estimates and may have reached significance with a larger sample.

Strengths and limitations: Strengths include prospective data capture, clinically meaningful endpoints (PONV, feeding, bowel function), and objective metabolic outcomes (glucose). Limitations include the non-randomized observational design, single-center setting, moderate sample size, and surgical heterogeneity without subgroup stratification. Subjective outcomes

(PONV, satisfaction) may be influenced by lack of blinding. Future randomized multicenter trials in Indian/Asian cohorts are warranted, ideally stratified by surgical category and incorporating cost-effectiveness and implementation fidelity within ERAS bundles.

Implications: For eligible non-diabetic patients, preoperative carbohydrate drinks represent a low-cost, low-risk intervention that meaningfully improves early recovery markers. We advocate formal incorporation into institutional ERAS pathways, alongside standardized antiemetic, analgesic, and mobilization protocols. Careful patient selection remains crucial—patients with suspected delayed gastric emptying or high aspiration risk require individualized plans.

# CONCLUSION

Preoperative ingestion of a 400 mL carbohydrate-rich clear beverage up to 2 hours before anesthesia was safe and improved key recovery endpoints in non-diabetic adults—reducing PONV, accelerating return of bowel function, improving glycemic control, and enhancing patient satisfaction—without aspiration events. These findings support routine inclusion of carbohydrate beverages in ERAS protocols for appropriately selected patients and encourage further randomized evaluation to refine indications and quantify benefits across diverse surgical populations.

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