

Metabolic Absorption of Protein and Fibre after Chyme Reinfusion in Type 2 Intestinal Failure



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Description of the initiative

- **Background / context:** Type 2 intestinal failure (T2IF) frequently occurs in septic, stressed, or metabolically unstable patients and may last for up to several months. Sarcopenia and reduction in short-chain fatty acid (SCFA)-production are common in patients with T2IF following bowel resection surgery. With the advancement of technology, chyme reinfusion (CR) has gained popularity in the nutritional management of T2IF by restoring digestive function and microflora to the downstream intestine.
- **Rationale:** The magnitude of effect of CR to the distal limb of the intestine on ingested protein absorption is not fully understood. Furthermore, although dietary fibre increases SCFA-producing bacteria, it is often withheld in T2IF. Consequently, it is unclear whether CR with soluble fibre can help restore colonic microbial function as measured by SCFA production.
- **Objectives and scope:** 1) Quantify relative dietary protein bioavailability in response to CR among patients with T2IF. 2) Investigate the relative extent of SCFA production from CR rich in soluble fibre.
- **Proposed study design:** A pretest-posttest feasibility study design involving eight T2IF patients post bowel resection eligible for CR; referenced against four healthy subjects.

Planned activities & deliverables

- **Steps:** Baseline protein absorption and fibre fermentation will be quantified using stable isotope methodology in eight T2IF patients following safe commencement of free oral fluids. Post-treatment outcomes will be measured 14-21 days after the establishment of full CR compared to four healthy subjects. All participants will sip an oral nutritional supplement (ONS) with the addition of ^{15}N -labelled spirulina protein and L-[ring- $^2\text{H}_5$] phenylalanine (PHE) every 20 min for 6 hours to determine relative protein absorption via the chyme and plasma ^{15}N PHE/ $^2\text{H}_5$ PHE ratio. Colonic fiber availability will be determined on a different day over a 7-h postprandial period via the addition of U- ^{13}C -labelled inulin to a single bolus of the same ONS. Blood and breath samples will be collected post feeding to quantify plasma ^{13}C -labeled SCFA and expired $^{13}\text{CO}_2$ appearance to assess the relative rate of soluble fiber fermentation with CR.
- **Deliverables and achievements in the next 12-24 months:** Quantification of the effect of CR on dietary protein absorption and SCFA production in T2IF compared to healthy controls.

Resources & enablers

- **Personnel, financial needs:** A multidisciplinary team of clinical dietitians, physiologists, and gastrointestinal surgeons from New Zealand will develop the research protocol and conduct the data collection and analysis. Funding of €30,000 is necessary to cover project costs.
- **Specify how the grant will be spent:** Funds will be spent towards research materials (€16,590) and mass spectrometry analyses (€20,912).
- **What factors will make it successful?** Collaboration with surgical services in District Health Boards and manufacturers of the ONS and chyme reinfusion technology in New Zealand. Increased awareness of CR among nutrition and medical professions. Promote the uptake of CR technique in clinical practice.

Results/outcomes & expected impact

- **How will the findings be implemented?** The findings will better inform upon dietary protein and fibre requirements for CR patients. Furthermore, to advance nutritional care in the clinical management of T2IF by justifying optimisation of dietary protein and soluble fibre content to be evaluated in a more extensive future clinical trial.
- **How will this project advance patient care / contribute to optimal nutritional care?** This is the first study to contribute evidence on protein and fibre metabolism in T2IF while receiving CR. The results will guide the development of suitable dietary strategies and practices to improve sarcopenia, promote beneficial colonic function, and potentially improve clinical outcomes by adopting these newly developed dietary strategies.
- **What makes the project innovative?** This will be the first in-depth investigation to quantify the specific nutritional influence of chyme on protein bioavailability and colonic microbial function in the distal limb of the intestine, which are important drivers of lean tissue preservation and metabolic health.
- **The publication of the project findings is expected to influence national nutrition policy.** The investigators are members of national and international professional societies, such as ASPEN, AuSPEN (a block member of ESPEN) that develop and publish clinical guidelines. Project findings should lead to improved nutrition policies in Australia and New Zealand for optimal management of disease related malnutrition in T2IF. Presentations at annual congresses and publication in house journals will promote and enable dissemination of the research findings.
- **The project can be easily transferred to other settings/countries.** Global expansion of our project findings will further assist the understanding and refinement of any resulting novel dietary strategies by contributing to international clinical practice guidelines to improve patient outcomes with CR therapy.