



The effect

OF ZESPRI™ GREEN KIWIFRUIT ON GASTROINTESTINAL COMFORT & FUNCTION



STUDY OBJECTIVE AND OVERVIEW

Globally, it is estimated that **functional gastrointestinal disorders AFFECT MORE THAN 40% OF PEOPLE** at any point in time.¹ Functional constipation (FC) impacts approximately **14% OF THE POPULATION**,² with **2.3% OF THE POPULATION** affected by irritable bowel syndrome with constipation (IBS-C),³ all of which can impact quality of life and health care use. Zespri Green Kiwifruit are known to help keep constipated individuals regular and previous studies have reported improvements in measures of gastrointestinal (GI) comfort such as bloating. The objective of this multi-country, randomised, controlled, cross-over clinical intervention study⁴ **was to investigate the effect of consuming 2 ZESPRI GREEN KIWIFRUIT daily for 4 weeks** compared to a commonly used supplement for constipation, psyllium, on GI comfort and function.

KEY FINDINGS

- Across all study sites (New Zealand, Japan, Italy), eating 2 Zespri Green Kiwifruit per day for 4 weeks **was significantly more effective than psyllium for reducing GI discomfort and improving measures of bowel habit.**
- Participants with FC or IBS-C saw a **clinically significant increase in the number of complete spontaneous bowel movements (CSBM; ≥ 1.5 CSBM per week)** during the kiwifruit intervention.
- **GI discomfort scores were significantly reduced in both the FC and IBS-C groups after eating kiwifruit.** These scores were of greater magnitude than that of psyllium.
- **Stool consistency, as measured by the Bristol Stool Form Scale, improved significantly in all study groups that ate Zespri Green Kiwifruit.** This was sustained over the intervention period and shown to be more effective than psyllium.
- **Quality of life (QoL) was significantly increased in the FC and IBS-C groups who ate kiwifruit.** Improvements in QoL related to IBS were seen for most of the subscales after eating kiwifruit.

This is the first time

EATING A FRESH, WHOLE FRUIT HAS DEMONSTRATED CLINICALLY RELEVANT INCREASES IN GI FUNCTION AND COMFORT IN PATIENTS WITH CONSTIPATION. JUST 2 ZESPRI GREEN KIWIFRUIT DAILY MAY THEREFORE BE A SUITABLE DIETARY OPTION FOR RELIEF OF CONSTIPATION.

STUDY METHODS



Figure 1. Map of participating study sites by country.

- 184 adults (74% female) between 18 to 65 years-old who had FC, IBS-C or were otherwise healthy were recruited for the study from 4 sites across 3 countries (see **Figure 1**). The study was 16 weeks in duration.
- Participants received 1 of the below interventions in random order for 4 weeks, then reversed to receive the alternate intervention for 4 weeks (see **Figure 2** for additional details on study flow):



Kiwifruit Group
2 Zespri Green/Day
5.5 grams of dietary fibre



Psyllium Group
7.5 grams/Day
~6 grams of dietary fibre

- Participants were given a daily bowel habit diary to record their bowel movements for all periods of the study. Participants visited clinic sites 6 times in total during the study to provide a stool sample, blood sample and complete various questionnaires.
- A more detailed study flow with evaluation time points can be found in **Figure 2**.

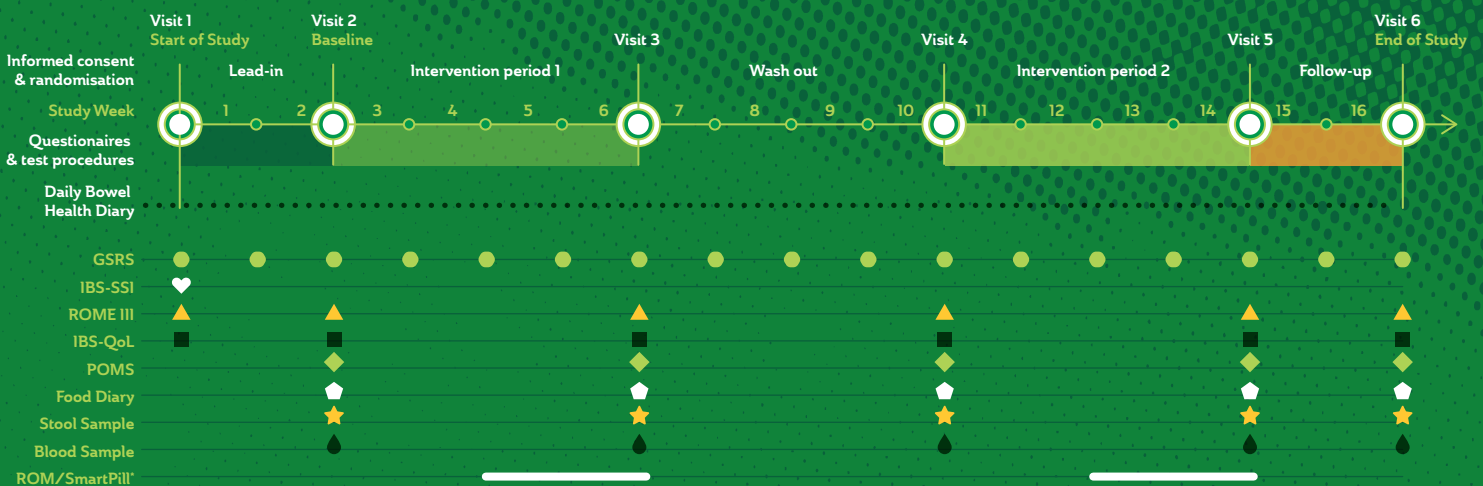


Figure 2. Study design and overview of study plan.

GSRS – Gastrointestinal Symptom Rating Scale; IBS-SSI – Irritable Bowel Syndrome – Symptom Severity Index; IBS-QoL – Irritable Bowel Syndrome – Quality of Life; POMS – Profile of Mood States; ROM – Radio-opaque markers. *ROM performed in Japan, SmartPill in NZ and Italy.

RESULTS

1. THE EFFECT OF EATING JUST 2 ZESPRI GREEN KIWIFRUIT DAILY TO IMPROVE MEASURES OF GI COMFORT IS CLEARLY DEMONSTRATED IN TABLE 1.
2. ZESPRI GREEN KIWIFRUIT HAS BEEN SHOWN TO CONSISTENTLY OUTPERFORM PSYLLIUM IN IMPROVING GI FUNCTION BY IMPROVING MEASURES OF GI COMFORT.

Table 1. Relationship of study outcomes between Zespri Green Kiwifruit and psyllium in constipated individuals.



Kiwifruit Group
2 Zespri Green/Day
5.5 grams of dietary fibre



Psyllium Group
7.5 grams/Day
~6 grams of dietary fibre

OUTCOME

CSBM (PER WEEK) A spontaneous bowel movement (i.e., not from rescue medication) with a sensation of complete evacuation.

GSRS TOTAL Self-perceived GI symptoms are better with a lower score.

GSRS CONSTIPATION

GSRS ABDOMINAL PAIN

GSRS INDIGESTION

BSFS* Assessment of stool form where Type 1 is the hardest and Type 7 is the softest (Type 3-5 considered "normal").
*Bristol Stool Form Scale

STRAINING Self-reported straining where less straining during bowel movements indicates less GI discomfort.

IBS-QOL Self-reported quality of life for individuals with functional bowel disorders – as scores increase, quality of life increases.

	FC	IBS-C	FC+IBS-C	FC	IBS-C	FC+IBS-C
CSBM (PER WEEK)	↑	↑	↑		↑	↑
GSRS TOTAL	↓	↓	↓		↓	
GSRS CONSTIPATION	↓	↓	↓		↓	
GSRS ABDOMINAL PAIN		↓	↓			
GSRS INDIGESTION		↓	↓			
BSFS*		↑	↑			
STRAINING		↓	↓			
IBS-QOL		↑	↑			

↑ Significantly increased outcome score or measure
↓ Significantly decreased outcome score or measure
Less favourable ranking of endpoints in hierarchical order based on the level of significance (p-value) for differences from the baseline.
FC – Functional Constipation; IBS-C – Irritable Bowel Syndrome with Constipation

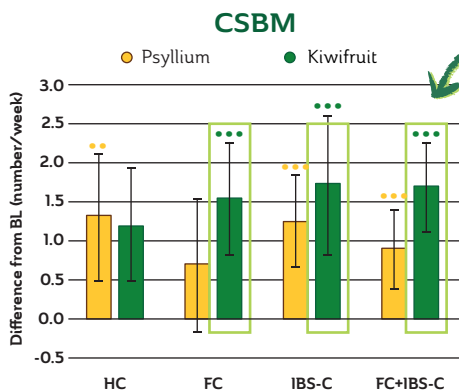


Figure 3. Change from baseline (BL) in CSBM frequency during interventions.

Note: •• <0.01 ••• <0.001

MORE FREQUENT SENSATIONS OF COMPLETE EVACUATION MEETING CLINICAL IMPROVEMENT THRESHOLDS.

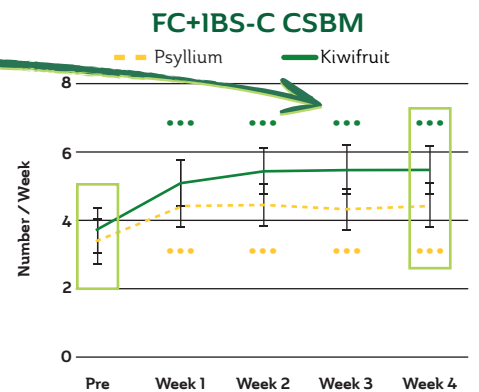
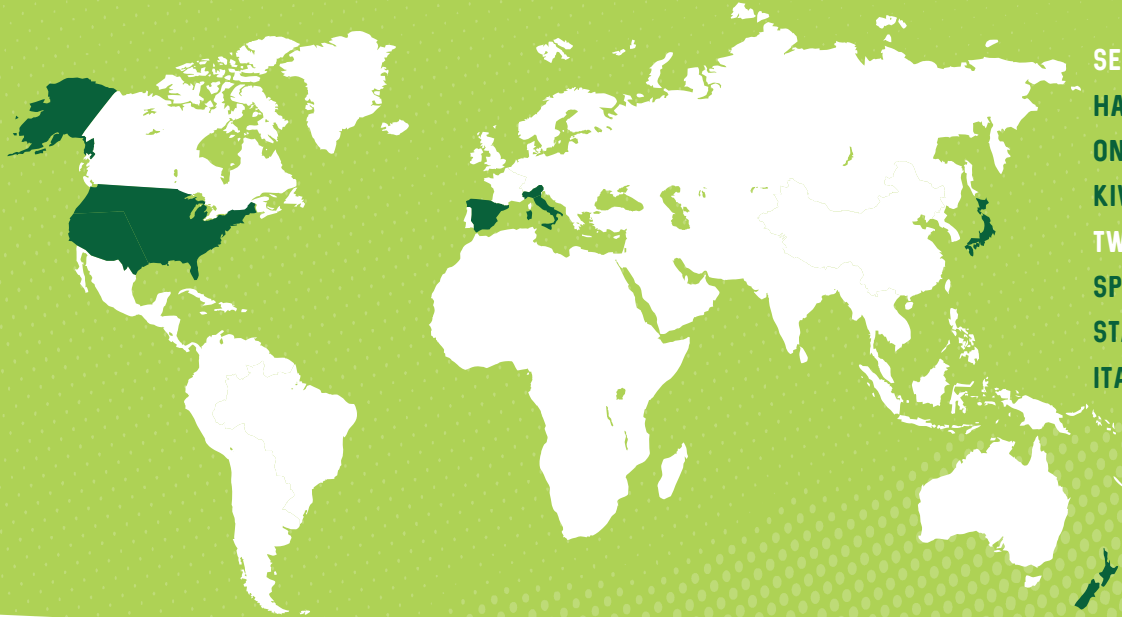


Figure 4. Weekly changes in CSBM frequency in constipated participants during intervention phases.

Note: ••• <0.001

STATE OF THE SCIENCE: REGULAR ZESPRI GREEN KIWIFRUIT CONSUMPTION AND GI COMFORT



SEVERAL RECENT CLINICAL TRIALS HAVE BEEN CONDUCTED TO-DATE ON THE ROLE OF ZESPRI GREEN KIWIFRUIT ON GI FUNCTION,⁵ TWO IN NEW ZEALAND,^{4,6} TWO IN SPAIN,^{7,8} ONE IN THE UNITED STATES OF AMERICA,⁹ AND ONE IN ITALY AND JAPAN,⁴ RESPECTIVELY.

Figure 5. Summary of clinical evidence found in support of Zespri Green Kiwifruit benefitting upper GI symptoms.

Evidence in support of an effect on:	Abdominal discomfort & pain	Abdominal bloating & distention	Indigestion
ZESPRI GREEN KIWIFRUIT	3 medium to high-quality studies reviewed with good evidence.	3 medium-quality studies were reviewed with medium evidence, mainly for short periods.	1 high-quality study was reviewed with good evidence.
SUMMARY	Evidence is good for Zespri Green Kiwifruit.	Evidence is medium for eating Zespri Green Kiwifruit over both short periods, and routinely.	Evidence is of high quality, but the number of studies needs to be expanded.

THERE IS CONSISTENT SCIENTIFIC EVIDENCE THAT EATING JUST

2 Zespri Green Kiwifruit

DAILY CAN BE CONSIDERED AN EFFECTIVE AND WELL TOLERATED DIETARY TREATMENT FOR RELIEF OF CONSTIPATION, AND PROVIDE CLINICALLY MEANINGFUL IMPROVEMENTS IN GI FUNCTION AND COMFORT.



Table 2. Summary of clinical evidence found in support of Zespri Green Kiwifruit and GI comfort.

References:

1. Sperber AD, Bangdiwala SI, Drossman DA, et al. Worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome Foundation Global Study. *Gastroenterology*. 2021;160(1):99-114.e3.
2. Barberio B, Judge C, Savarino EV, Ford AC. Global prevalence of functional constipation according to the Rome criteria: A systematic review and meta-analysis. *Lancet Gastroenterol Hepatol*. 2021;6(8):638-648.
3. Oka P, Parr H, Barberio B, Black CJ, Savarino EV, Ford AC. Global prevalence of irritable bowel syndrome according to Rome III or IV criteria: A systematic review and meta-analysis. *The Lancet Gastroenterology & Hepatology*. 2020;5(10):908-917.
4. Geary R, Barbara G, Fukudo S, et al. Consumption of two green kiwifruit daily improves constipation and abdominal comfort – results of an international multicentre randomised controlled trial. 2022. Manuscript under submission.[^]
5. Bayer SB, Frampton CM, Geary RB, Barbara G. Habitual green kiwifruit consumption is associated with a reduction in upper gastrointestinal symptoms - a systematic scoping review [published online ahead of print, 2022 Mar 10]. *Adv Nutr*. 2022;nmac025. doi:10.1093/advances/nmac025.
6. Wallace A, Eady S, Drummond L, et al. A pilot randomized cross-over trial to examine the effect of kiwifruit on satiety and measures of gastric comfort in healthy adult males. *Nutrients*. 2017;9(7):639.
7. Caballero N, Benslaiman B, Ansell J, Serra J. The effect of green kiwifruit on gas transit and tolerance in healthy humans. *Neurogastroenterol Motil*. 2020;32(9):e13874.
8. Cunillera O, Almeda J, Mascort JJ, Basora J, Marzo-Castillejo M. Mejora del estreñimiento funcional con la ingesta de kiwi en una población mediterránea: Estudio piloto abierto no randomizado. *Revista Española de Nutrición Humana y Dietética*. 2015;19(2):58-67.
9. Chey SW, Chey WD, Jackson K, Eswaran S. Exploratory comparative effectiveness trial of green kiwifruit, psyllium, or prunes in US patients with chronic constipation. *Am J Gastroenterol*. 2021;116(6):1304-1312.

[^]This is a Zespri International Ltd. funded study. Publication is currently under preparation. Zespri personnel did not participate in the design, conduct, or analysis, of the study.