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Harnessing Whole-Fruit Carob for Gut Health and Metabolic Benefits

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Pharmactive Biotech Products has developed Csat, a whole-fruit carob formulation combining galactomannans, inositols and polyphenols from carob seed and pulp



Ivan Benito-Vazquez, PhD, R&D Project Leader, Pharmactive Biotech Products, S.L.U.

As growing scientific interest focuses on the role of gut microbiota in metabolic health, plant-derived ingredients offering multiple complementary bioactive compounds are gaining attention in the functional food and nutraceutical sectors. Pharmactive Biotech Products has developed Csat, a whole-fruit carob formulation combining galactomannans, inositols and polyphenols from carob seed and pulp, designed to explore the interconnected pathways influencing gut health, metabolic signalling and appetite regulation.

Recent in vitro research published in Bioscience (February 2026) and the Journal of Functional Foods (July 2026) has highlighted the ingredient's potential to enhance short-chain fatty acid production through gut microbial activity and stimulate the release of satiety-related hormones GLP-1 and cholecystokinin (CCK). While human clinical studies are still needed to establish these effects, the findings offer promising research directions for metabolic health applications.

In this interview with NUFFOODS Spectrum, Ivan Benito-Vazquez, PhD, R&D Project Leader, Pharmactive Biotech Products, S.L.U., discusses the scientific rationale behind Csat, its proposed mechanisms of action, the significance of the latest research findings, and its potential applications in functional foods and dietary supplements. He also outlines the research required to translate laboratory findings into clinically established health benefits.

What was the scientific rationale behind developing Csat as a whole-fruit carob formulation, and how do its key components—including galactomannans, inositols, and polyphenols—work together to deliver potential metabolic health benefits?

Our approach was based on a simple idea: why isolate one compound when carob naturally contains several with complementary biological activities? Csat combines galactomannans, inositols, and polyphenols from carob seed and pulp. Rather than targeting a single mechanism, we wanted to explore how these components interact. Our latest research suggests that this combination is particularly interesting for investigating the links between gut microbiota and metabolic signalling.

The February 2026 study published in Bioscience found that Csat generated higher levels of acetate, propionate, and butyrate than the individual carob fractions. What do these findings reveal about the synergistic effects of carob seed fibres and pulp compounds on gut microbial activity?

Our findings suggest that Csat promotes microbial cross-feeding, with carob seed fibres stimulating primary fermenters such as Bacteroides, while pulp bioactives support secondary fermenters such as Anaerostipes and Blautia. This synergistic interaction makes Csat, which combines all these bioactive compounds in a single ingredient, more efficient at promoting a balanced gut microbiota and enhancing the production of acetate, propionate, and butyrate than the individual carob fractions.

The July 2026 study in the Journal of Functional Foods reported increased GLP-1 and cholecystokinin (CCK) release in an in vitro intestinal cell model. What mechanisms might explain this response, and how could it translate into potential applications for satiety and weight management?

Interestingly, Csat stimulated GLP-1 and CCK secretion after simulated digestion, but not in its undigested form. This suggests that digestion plays an important role in releasing or transforming bioactive compounds. Since both hormones participate in satiety signalling, these findings open an interesting avenue for further research into appetite regulation. However, clinical studies are needed to determine whether these effects translate into measurable benefits in humans.

Given that both studies were conducted in vitro, what further preclinical and human clinical research is needed to establish Csat's efficacy, optimal dosage, safety, and long-term benefits for gut health and metabolic outcomes?

Human clinical trials are the next essential step. Our preclinical and in vitro studies have identified promising mechanisms involving microbial fermentation and intestinal hormone signalling. We now need to establish whether these findings translate into measurable physiological effects, while determining appropriate dosages, tolerability, and long-term outcomes. Understanding individual differences in gut microbiota will also be particularly interesting.

How does Csat compare with existing fibre-based prebiotics and other plant-derived ingredients targeting gut health, appetite management, and blood sugar regulation? What formulation advantages does its combination of fibres and polyphenols offer to food and nutraceutical manufacturers?

What makes Csat unique is its ability to bring together multiple complementary functions in a single ingredient, addressing the multifactorial nature of metabolic syndrome. This is achieved through multiple standardization, where we quantify individual bioactive compounds, including galactomannans, inositols, and polyphenols, each associated with specific physiological functions. Such standardization is technically challenging, as it requires different analytical methods within a single ingredient.

Furthermore, our in vitro digestion and fermentation studies allow us to understand how these compounds evolve throughout digestion and their potential direct and microbiota-mediated effects on metabolic health. For manufacturers, this translates into a scientifically characterized, multifunctional ingredient that simplifies formulation while targeting several interconnected metabolic pathways.

What commercial opportunities do you see for Csat across functional foods, dietary supplements, and other health-focused product categories? How is Pharmactive working with manufacturers to incorporate the ingredient into consumer-friendly formulations while communicating its benefits within the scope of current scientific evidence?

We see opportunities for Csat® in functional foods and dietary supplements, particularly as interest grows in the relationship between gut microbiota, metabolism, and satiety signalling. At Pharmactive, we work with manufacturers by providing scientific and technical support to explore suitable formulations. Our priority is to communicate the findings

accurately, highlighting the mechanisms identified in laboratory studies while continuing to build the clinical evidence needed to establish benefits in humans.