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Title:

Fermentability of gelling polysaccharides: influence of polymer type and physical state with implications for food design

Authors & affiliations:

<i>Name and surname</i>	<i>Institution/ Department, University, Country</i>
<i>Anqi Li¹, Bernadine M. Flanagan¹, Heather M. Shewan², Deirdre Mikkelsen³, Michael J. Gidley¹</i>	
<i>1. Centre for Nutrition and Food Sciences, Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland, Brisbane, 4072, Australia</i>	
<i>2. School of Chemical Engineering, The University of Queensland, Brisbane, 4072, Australia</i>	
<i>3. School of Agriculture and Food Sustainability, The University of Queensland, Brisbane, 4072, Australia</i>	

Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word **ONLY** (place names excluded). No full stop at the end.

2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Gelling polysaccharides are widely used in the food industry to achieve desirable textures in food products. Beyond their technological roles, they are important dietary components, with fermentability serving as a key determinant of nutritional functionality in the human gut. Depending on the rate and extent of gut microbial fermentation, gelling polysaccharides could contribute to beneficial outcomes through sustained production of beneficial metabolites such as short-chain fatty acids (SCFA) and/or maintaining digesta hydration to support passage regularity. It was hypothesised that extensive fermentation would occur for polysaccharides with chemical structures common in local diets and that gelation would slow fermentation compared with powder/solution forms.

Following an earlier investigation of pectin and alginate in solution and gel forms, this study examined the *in vitro* fermentation of seven gelling polysaccharides used as food additives—konjac glucomannan (KGM), curdlan (CRD), sugar beet pectin (SBP), agar (AGA), agarose (AGR), high-acyl gellan (HGL), low-acyl gellan (LGL), and methylcellulose (MC)—using human faecal inoculum. Fermentation was assessed through gas formation and SCFA production in both gel and powder forms.

Results showed that KGM, CRD, and SBP were highly fermentable, while AGA, AGR, HGL, and MC displayed limited fermentation. Poor fermentability was likely related to a lack of microbial enzymes capable of depolymerising substrates due to limited prior dietary exposure. Gel formation slowed fermentation kinetics and reduced overall SCFA production in highly fermentable substrates but could influence SCFA profiles; for instance, CRD gels generated a higher proportion of butyrate than CRD powders. Gelation had minimal impact on poorly fermentable polysaccharides.

These findings demonstrate the combined influence of polymer type and physical form on gut fermentation. By linking polysaccharide physicochemical properties with fermentation outcomes, this study provides a framework for the food industry to optimise ingredient selection and formulation strategies that balance product functionality with potential gut health benefits.

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