Differential bacterial capture and transport preferences facilitate co-growth on dietary xylan in the human gut

Metabolism of dietary glycans is pivotal in shaping the human gut microbiota. However, the mechanisms that promote competition for glycans among gut commensals remain unclear. *Roseburia intestinalis*, an abundant butyrate-producing Firmicute, is a key degrader of the major dietary fibre xylan. Despite the association of this taxon to a healthy microbiota, insight is lacking into its glycan utilization machinery. Here, we investigate the apparatus that confers *R. intestinalis* growth on different xylans. *R. intestinalis* displays a large cell-attached modular xylanase that promotes multivalent and dynamic association to xylan via four xylan-binding modules. This xylanase operates in concert with an ATP-binding cassette transporter to mediate breakdown and selective internalization of xylan fragments. The transport protein of *R. intestinalis* prefers oligomers of 4-5 xylosyl units, whereas the counterpart from a model xylan-degrading *Bacteroides* commensal targets larger ligands. Although *R. intestinalis* and the *Bacteroides* competitor co-grew in a mixed culture on xylan, *R. intestinalis* dominated on the preferred transport substrate xylotetraose. These findings highlight the differentiation of capture and transport preferences as a possible strategy to facilitate co-growth on abundant dietary fibres and may offer a unique route to manipulate the microbiota based on glycan transport preferences in therapeutic interventions to boost distinct taxa.

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