Differential bacterial capture and transport preferences facilitate co-growth on dietary xylan in the human gut - DTU Orbit (17/08/2019)

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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.