Structural basis for arabinoxylo-oligosaccharide capture by the probiotic Bifidobacterium animalis subsp. lactis BI-04

Glycan utilization plays a key role in modulating the composition of the gut microbiota, but molecular insight into oligosaccharide uptake by this microbial community is lacking. Arabinoxylo-oligosaccharides (AXOS) are abundant in the diet, and are selectively fermented by probiotic bifidobacteria in the colon. Here we show how selectivity for AXOS uptake is established by the probiotic strain Bifidobacterium animalis subsp. lactis BI-04. The binding protein BIAXBP, which is associated with an ATP-binding cassette (ABC) transporter that mediates the uptake of AXOS, displays an exceptionally broad specificity for arabinosyl-decorated and undecorated xylo-oligosaccharides, with preference for tri- and tetra-saccharides. Crystal structures of BIAXBP in complex with four different ligands revealed the basis for this versatility. Uniquely, the protein was able to recognize oligosaccharides in two opposite orientations, which facilitates the optimization of interactions with the various ligands. Broad substrate specificity was further enhanced by a spacious binding pocket accommodating decorations at different mainchain positions and conformational flexibility of a lid-like loop. Phylogenetic and genetic analyses show that BIAXBP is highly conserved within Bifidobacterium, but is lacking in other gut microbiota members. These data indicate niche adaptation within Bifidobacterium and highlight the metabolic syntrophy (cross-feeding) among the gut microbiota.
Scopus rating (2011): CiteScore 4.72 SJR 3.475 SNIP 1.285
Web of Science (2011): Impact factor 5.01
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 3.678 SNIP 1.203
Web of Science (2010): Impact factor 4.819
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.981 SNIP 1.333
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.974 SNIP 1.222
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 3.868 SNIP 1.252
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 4.331 SNIP 1.37
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 4.094 SNIP 1.358
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.707 SNIP 1.345
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 3.833 SNIP 1.349
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.984 SNIP 1.448
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 4.07 SNIP 1.475
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 4.274 SNIP 1.58
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 4.323 SNIP 1.563
Original language: English
DOIs:
10.1111/mmi.12419
Source: dtu
Source-ID: n:oai:DTIC-ART:blackwell/426405908::34539
Research output: Research - peer-review › Journal article – Annual report year: 2013