糖質科学セミナー

A snapshot of oligosaccharide and polysaccharide catabolism in two widely used probiotic bacteria

Associate Professor

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The Technical University of Denmark

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■会場：新潟大学農学部 A506-2
■主催：新潟大学企画戦略本部若手研究者育成推進室
■協賛：新潟大学地域連携フードサイエンスセンター

新潟大學

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■Career Summary

Maher Abou Hachem has obtained his MSc in chemical engineering from the University of Lund, Sweden in 1998 and his PhD in Biotechnology from the same University in 2003. Thereafter, Maher Abou Hachem Joined the Carlsberg Laboratory in Copenhagen, for a short post-doctoral research project. In 2004, Maher Joined the Technical University of Denmark as a post-doctoral fellow at the Laboratory of Professor Birte Svensson, where he in 2008 was appointed as an Associate Professor in Food Protein Chemistry, and he is still active in this position.

■Research Areas

Carbohydrate active enzymes/proteins from probiotics, and catabolism of carbohydrate prebiotics.

Modular glycoside hydrolases and carbohydrate binding modules active on hemi-cellulose and starch.

Enzymology and interactions of carbohydrate active proteins with carbohydrate substrates/inhibitors/metal-ion ligands.

■Academic Society Affiliation

■Main Publications

1. **Abou Hachem, M**., Karlsson, E.N., Simpson, P.J., Williamson, M.P., Seller, P., Linse, S., Gilbert, H.J., Bolam D.N., and Holst, O. (**2002**) Calcium binding and thermodynamic studies on the thermostable carbohydrate binding modules of Xyn10A *Rhodothermus marinus*. ***Biochemistry*** **41**, 5720-5729

2. Christiansen, C., **Abou Hachem, M**., Janeček, S., Viksø-Nielsen, A., Blennow, A., Svensson, B. **(2009)** The carbohydrate binding module family 20 - diversity, structure and function. ***FEBS J*** 276, 5006-5029.

3. Fredslund, F., **Abou Hachem, M**., Jonsgaard Larsen, R., Gerd Sørensen, P., Coutinho, P.M., Lo Leggio, L. and Svensson, B. **(2011)** Crystal structure of α-galactosidase from *Lactobacillus acidophilus* NCFM: insight into tetramer formation and substrate binding. ***JMB*** 412, 466-480

4. Andersen J.M., Barrangou R., **Abou Hachem M**., Lahtinen S., Goh Y.-J., Svensson B., Klaenhammer T. R. **(2011)** Transcriptional and functional analysis of galactooligosaccharide uptake by lacS in *Lactobacillus acidophilus* ***PNAS*** 108, 2651-2655

5. Møller M.S., Fredslund, F., Majumder, A., Nakai H., Poulsen, J.-C. N., Lo Leggio, L., Svensson, B., **Abou Hachem, M**. **(2012)** Enzymology and structure of the GH13_31 glucan 1,6-α-glucosidase that confers isomaltooligosaccharide utilisation in the probiotic *Lactobacillus acidophilus* NCFM ***J. Bacteriol*** (In press)

Abstract

The interplay between diet and probiotic bacteria, mainly from the *Lactobacillus* and *Bifidobacterium* genera, has a major impact on human health *e.g*. pathogen protection, certain gastroinestinal disorders, cancers and allergic disorders [1]. Carbohydrate prebiotics comprising mainly non-digestible oligosaccharides but also a few polysaccharides, alter the balance between gut microbiota by selectively stimulating the growth of probiotics. Thus, carbohydrate catabolism and transport has been implicated as an attribute of probiotic action [2]. To shed light on this facet of probiotics, we have investigated the utilization various glycosides in the two model commercial probiotics strains *Lactobacillus acidophilus* NCFM and *Bifidobacterium animalis* subsp. *lactis* Bl-04 using proteomic and transcriptomic techniques. Selected target enzymes and proteins were heterologously produced and characterized. Results from this study will be presented with focus on the routes of utilization of α-glucosides and galactosides in these two organisms. These results suggest the presence of diverse routes of utilization of studied saccharides with respect to hydrolases and transport proteins. Interestingly, our results show that the utilization of related glycosides is sometime linked on the genetic, transcriptional and sometimes on the protein levels.

1 O'Flaherty, S. and Klaenhammer, T. R. (2010) The role and potential of probiotic bacteria in the gut, and the communication between gut microflora and gut/host. International Dairy Journal. **20**, 262-268

2 Fukuda, S., Toh, H., Hase, K., Oshima, K., Nakanishi, Y., Yoshimura, K., Tobe, T., Clarke, J. M., Topping, D. L., Suzuki, T., Taylor, T. D., Itoh, K., Kikuchi, J., Morita, H., Hattori, M. and Ohno, H. (2011) Bifidobacteria can protect from enteropathogenic infection through production of acetate. Nature. **469**, 543-U791