Resistant Starch: Physiological Effects and *in vitro* Fermentability

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**Summary**

Resistant starch (RS) is defined as the sum of starch and starch degradation products that resist digestion in the small intestine. Based on chemical and physical characteristics, RS is classified into four different types: RS1 includes starch that is physically inaccessible to digestive enzymes (e.g. due to the presence of intact cell walls in grains or seeds), RS2 comprises resistant B-type starch granules as present in raw potatoes and green bananas, RS3 describes retrograded starch occurring in processed foods (e.g. cooked and cooled potatoes, bread, cornflakes) and RS4 refers to chemically modified starches (e.g. ethers, esters), which are used to improve functional characteristics in foods. In addition to the natural sources, some commercially manufactured RS2 and RS3 preparations are available. They may be used to reduce available carbohydrate and/or energy content as well as to increase the fibre content of foods. Compared to many traditional fibre sources, RS is characterised by a high palatability.

RS is considered to contribute to indigestible carbohydrate related health effects. Beside its indigestibility, its partial or complete fermentation in the large intestine is a prerequisite to be classified as dietary fibre. Dietary RS consumption varies considerably. It is estimated that intakes in developing countries with high starch consumption may reach 40 g/day, whereas assessments in European countries mainly indicate values of < 10 g/day. Being part of the substrates entering the human colon, RS contributes to health effects in the large bowel. Recent studies have confirmed the ability of RS to increase faecal bulk, to enhance short chain fatty acid production in general and butyrate in particular as well as to dilute faecal bile acids. Moreover, interest is increasing regarding its prebiotic potential. In contrast, its impact on glucose and lipid metabolism seems to be weak as compared to viscous dietary fibre. It has to be mentioned however, that comparisons between studies showing health effects are hampered by differences in study design as well as in source, type and dose of RS.

*In vitro* fermentation experiments are flexible and easy to perform. As long as they are carried out under standardised conditions, they are useful tools for screening experiments in order to reduce time and effort needed to carry out complex *in vivo* studies. Moreover, kinetics of substrate degradation as well as fermentation metabolite production can easily be followed. The batch methodology developed at ETH Zurich has been applied on RS preparations under various aspects. When comparing different RS preparations, it could be shown that RS2 was more slowly degraded by colonic microbiota than RS3. Additionally, differences in fermentability were observed within RS types. Another series of experiments revealed that RS as a butyrogenic substrate may be handled in a donor-specific way. Although overall reproducibility between fermentation experiments carried out with identical substrates turned out to be very good, distinct differences in butyrate production from RS3 were observed. Despite the fact that faecal material mixtures obtained from various individuals were used for the different experiments, low butyrate production could be clearly attributed to one specific donor. Such effects are supposed to happen *in vivo* as well. Additionally, it could be shown that the ability of colonic bacteria to degrade RS is only established during weaning, i.e. at the stage at which microbiota composition diversifies considerably due to the introduction of solid food. Faecal samples of breast-fed and formula-fed infants, respectively, were not able to metabolise RS3. With bacteria collected from infants at weaning however, the substrate was degraded completely, but slower than by those obtained from adults. Microbiota of elderly people showed a slightly diminished activity again.
Beamer-Presentation shown at the meeting.

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