Effect of apple pectin on gut microbiota - qPCR in applied microbiology

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Introduction: This study was part of the ISAFRUIT project, which aims to reveal biological explanations of the health effects of fruits. A number of health related targets may be affected by the intestinal microbiota e.g. immune system regulation, cancer prevention, enteric infection resistance and obesity control. Generally, the Gram-positive, fermenting bacterial populations (including Bifidobacteria and Lactobacillus) are considered biomarkers of a well-balanced intestinal microbiota, whereas overgrowth of certain Bacteroides species is considered undesirable. Moreover, butyrate-producing Clostridial clusters is considered beneficial to the gut mucosa as butyrate functions as a fuel for enterocytes. The objective of this study was to identify effects of apple and apple product consumption on the microbiota.

Model: Male Fisher rats were subjected to two long-term (14 weeks) and one short-term feeding study (4 weeks) with whole apples or selected apple components. Effects on microbial composition was analyzed with Principal Component Analysis (PCA), denaturing gradient gel electrophoresis (DGGE) and quantitative real-time PCR (q-PCR).

Results: The decrease in certain Bacteroides species and increase in Clostridium coccoides identified in pectin treated animals by DGGE was successfully verified by quantitative real-time PCR using SybrGreen on ABI prism 7900HT from Applied Biosystems.

Discussion+Conclusions: The decrease in certain Bacteroides species and increase in Clostridium coccoides identified in pectin treated animals by DGGE was successfully verified by Q-PCR. Burytul-CoA is present in butyrate-producing bacteria such as in certain Clostridial clusters, which fits well with a similar 4-fold increase for these primers sets in pectin treated animals. We also found (not shown) that pectin decreased pH and increased bacterial fermentation, coinciding well with the tendency to increased Bifido and Lactobacillus levels.

The collected evidence thus suggests that apples have a health-promoting effect on the rat intestinal microbiota, and that this effect is mainly explained by the presence of pectin in the apples.

However, a human being must eat 3 kg apples a day to reach an intake corresponding to 0.15% pectin. The data presented here will at a later stage be interpreted in the context of other biological changes recorded during the course of the ISAFRUIT project, which includes also human intervention studies.