Abundance and distribution of mucosa-associated hydrogenotrophs in the healthy colon and in inflamed and non-inflamed tissues of IBD patients

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Stool samples have been used extensively for gut microbiota composition studies, but they do not adequately represent the mucosa-associated microbiota. An even greater challenge is to characterize low abundant microbial communities from colonic tissues such as hydrogenotrophic microbiota. Here, biopsies from healthy and inflammatory bowel disease (IBD) patients were used to examine the mucosa-associated acetogens, sulfate-reducing bacteria (SRB) and methanogenic archaea (MA), the last two groups have been linked to chronic inflammation and intestinal homeostasis, respectively. The abundance of the three groups was quantified through qPCR targeting the functional genes and 16S rRNA genes for different SRB genera. The three hydrogenotrophic groups were ubiquitously associated with the colonic mucosa in right-colon, left-colon or rectum of twenty-five healthy subjects. Methanogens were the most abundant hydrogenotrophs and together with acetogens increased in abundance from right colon to rectum. Conversely, SRB were more abundant in right colon and very sparse in rectum. These data indicate that there may not be a direct correlation between the presence of mucosal MA and detection of breath methane since detectable breath methane concentrations greater than 1 ppm have historically been detected in 30-60% of Caucasians, which comprised our subjects. Among these 25 subjects, five provided replicate biopsies less than 1 cm apart. Variable dsrA and mcrA quantities were detected for most of the replicates indicating the likelihood of microheterogeneity in mucosal hydrogenotrophs. Biopsies, in some instances taken from inflamed and adjacent non-inflamed tissue, from 11 Crohn’s disease and four ulcerative colitis patients were also quantified hydrogenotrophic microbes abundance. A greater abundance (10 folds) of SRB, in particular the genus Desulfotomaculum was detected in inflamed tissue In contrast to the healthy individuals, SRB were more consistently abundant in the three regions, and a more stable composition in the three groups was thus observed throughout the colon. This increased prevalence of SRB in IBD patients is consistent with the proinflammatory properties of hydrogen sulfide, the end product of sulfate respiration. Together the data confirm the prevalence of acetogens, SRB and MA in colonic mucosa of healthy subjects and are consistent with a possible influence of SRB on chronic inflammation.