Whole grains in food transport bacteria and extend fermentation to the distal colon in humans

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As food particles pass through the ruminant gut they become covered by bacteria (1). This attachment appears to be an important determinant of starch fermentation since the activity of bacterial polysaccharide degrading enzymes is higher in cells bound to particles (2,3). There is evidence that similar effects may occur in humans (4) and we have conducted experiments with human subjects fed whole grain diets to investigate the effect of food particles on fermentation related colonic events.

Two high fibre diets were prepared that were identical in terms of both foods and macronutrient composition. They differed only in respect of the physical preparation of the cereal and leguminous seed ingredients that were whole in one diet (diet W) and comminuted before incorporation into equivalent foods of the other diet (diet P). Twelve healthy volunteers aged 22 to 50 years consumed each diet for a period of 7 days in a random crossover design during which they consumed 66±13g dietary fibre/day. Diet W produced an increase ($P<0.05$) in mean daily faecal output (from 156 ± 22 to 263 ± 34 g/day) and an increase ($P<0.05$) in the mean number of daily defaecations (from 1.3 ± 0.2 to 1.8 ± 0.2 per day). There were more ($P<0.05$) large particles (>3mm) in stools on diet W (8 ± 2.7%) than on diet P (2 ± 1.4%) and diet W was associated with a significant ($P<0.05$) lowering of faecal pH (from 6.6 ± 0.1 to 6.2 ± 0.1). Changes in whole gut transit times and faecal butyrate concentrations were not significantly different.

Stools from diet W contained apparently intact wheat grains. Internally however the endosperm of these grains was extensively eroded. Electron microscopy revealed that the internal surfaces were coated with currently unidentified bacterial rods and cocci. Fermentation of non-starch polysaccharides and resistant starch in the distal colon may protect against cancer in this region (5). The physical structure of dietary whole grains may be an important contributor to this effect by acting both as transport vehicles and as substrates for carbohydrate fermenting bacteria whose activity beneficially modulates the luminal environment of the large bowel.

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