12. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc. 2000;32:963-75.

13. Van Sluisj EM, McMinn AM, Griffin SJ. Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials. BMJ. 2007;335:677-8.

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Gastrointestinal flora composition and health

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In this issue, de Mello et al. report that lactobacilli (Lb) and bifidobacteria (Bif) contents of the gastrointestinal flora differ according to socioeconomic status.[1] The authors suggest a relation between nutritional status and gastrointestinal flora, since a low number of Lb and Bif was associated with a low body mass index.[1] Whether this association should be regarded as "causal" or more as a "consequence" is not clear. Children living in favelas have an increased risk to develop environmental enteropathy. Although the volume of stools may be an influencing factor (children in favelas producing significantly larger volumes of stools, and therefore resulting in smaller amounts of colony forming units per gram of stool), the fact that Lb and Bif were absent in about 10% of the stools of children living in favelas but present in all upper-class children is a strong argument against this hypothetical bias.

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The hygiene hypothesis suggests that "Western style" living conditions favor immune-mediated diseases, such as diabetes, atopic disease, inflammatory bowel disease, and many others, whereas an increased contact with endotoxins protects against the development of atopic manifestations.[2] A decrease in frequent viral infectious diseases such as hepatitis A was associated with an increased incidence of atopic disease.[3] Decreased numbers of Lb and Bif have been shown to predispose to atopic disease when comparing gastrointestinal flora in Estonia and Sweden[4]: children living in Estonia presented a decreased incidence of atopic disease and higher counts of Lb and Bif. Moreover, atopy is reduced in children of families with an anthroposophic lifestyle.[5] In comparison with a control population, these children experienced a reduced use of antibiotics (52 vs. 90%), a reduced vaccination rate for measles, mumps and rubella (18 vs. 93%), and an increased consumption of fermented foods (63 vs. 4.5%).[5] Lifestyle factors related to an anthroposophic way of life influence the composition of the gut flora in infants, increasing the number of Lb.[6]

A superficial interpretation of the evidence found in the literature may seem to suggest that the Western lifestyle predisposes to immune-mediated diseases and that this is at least in part related to a decreased incidence of Lb in the gastrointestinal flora; in addition, it may seem to suggest that a non-Western lifestyle, as occurs in the favelas, will stimulate the predominance of Lb and Bif in the gastrointestinal flora. However, dietary intake will substantially determine gastrointestinal flora composition. The intake of fermented foods and prebiotic oligosaccharides is (or was) reduced in Western dietary habits.[7] On the other hand, dietary intake in very poor living conditions as is the case in the favelas also seems to reduce the numbers of Lb and Bif.[1] Prebiotic oligosaccharides stimulate the development of Lb in the gastrointestinal flora. And Lb have been shown to adhere to the gastrointestinal mucosa, to cause a steric hindrance for pathogens to adhere, and to stimulate immune development by an increased IgA secretion and mucin production. Probiotic

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bacteria and prebiotic oligosaccharides stimulate the development of Peyer's patches and thus stimulate the development of a better immune response.[8,9] Lb increase mucin production.[10,11] All this will result in a decreased stool pH and in the production of short-chain fatty acids. A decreased number of Lb results in increased intestinal permeability.

However, other considerations should be considered as well. Only a minority of the microorganisms present in the gastrointestinal tract can be cultured. Also, the results of stool cultures are not necessarily representative of the gastrointestinal flora in the digestive system, more specifically in the small bowel, cecum and colon ascendens.

Low counts of Lb may be the consequence of Western dietary habits and are also observed in children living in poor conditions in favelas in Brazil. In children with a low body mass index, the number of Lb is even further reduced. However, it is unclear if the decreased number of Lb and Bif is favoring the malnutrition, or whether it is the consequence of the latter. Children living in favelas have an increased contact with pathogens since they have almost no legal water supply connection and no garbage collection. In conclusion: "the more lactobacilli, the better" seems to be a reality.

References

1. de Mello RM, de Morais MB, Tahan S, Melli LC, Rodrigues MS, Mello CS, et al. Lactobacilli and bifidobacteria in the feces of schoolchildren of two different socioeconomic groups: children from a favela and children from a private school. J Pediatr (Rio J). 2009;85:307-14.
2. Braun-Fahrländer C, Riedler J, Herz U, Eder W, Waser M, Grize L, et al. Environmental exposure to endotoxin and its relation to asthma in school-age children. N Engl J Med. 2002;347:869-77.
3. Matricardi PM, Rosmini F, Ferrigno L, Nisini R, Rapicetta M, Chionne P, et al. Cross sectional retrospective study of prevalence of atopy among Italian military students with antibodies against hepatitis A virus. BMJ. 1997;314:999-1003.
4. Björksten B, Naaber P, Sepp E, Mikelsaar M. The intestinal microflora in allergic Estonian and Swedish 2-year-old children. Clin Exp Allergy 1999;29:342-6.
5. Alm JS, Swartz J, Lilja G, Scheynius A, Pershagen G. Atopy in children of families with an anthroposophic lifestyle. Lancet. 1999;353:1485-8.
6. Alm JS, Swartz J, Björkstén B, Engstrand L, Engström J, Kühn I, et al. An anthroposophic lifestyle and intestinal microflora in infancy. Pediatr Allergy Immunol. 2002;13:402-11.
7. Bengmark S. Bacteria for optimal health. Nutrition. 2000;16:611-5.
8. Singer E, Mullie C, Odou MF, Romond MB. Influence of a fermented milk on the promotion of Peyer's patchesin human flora associated mice. J Pediatr Gastroenterol Nutr. 2004;39:S90.
9. Mannhart N, Spittler A, Bergmeister H, Mittlböck M, Roth E. Influence of fructooligosaccharides on Peyer\'s patch lymphocyte numbers in healthy and endotoxemic mice. Nutrition. 2003;19:657-60.
10. Deplancke B, Gaskins HR. Microbial modulation of innate defense: goblet cells and the intestinal mucus layer. Am J Clin Nutr. 2001;73:1131S-1141S.
11. Mack DR, Ahrne S, Hyde L, Wei S, Hollingsworth MA. Extracellular MUC3 mucin secretion follows adherence of Lactobacillus strains to intestinal epithelial cells in vitro. Gut. 2003;52:827-33.

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