

## Continuing Low Colon Cancer Incidence in African Populations

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## EDITORIALS

### Continuing Low Colon Cancer Incidence in African Populations

In all big towns and cities in developing populations there are ongoing transitions in environmental factors—in dietary composition, physical activity, smoking practice, alcohol consumption, and stress. Contemporaneously, changes have occurred in the patterns of health/ill-health experienced. In South Africa, apart from major falls in the morbidity and mortality of young children, the urban African population has raced ahead of the white population in respect to the prevalence of obesity in women, hypertension, and diabetes (1). Yet, in remarkable contrast, minimal changes have occurred in the incidence of colonic diseases—diverticular disease, inflammatory bowel disease, and colorectal cancer. Furthermore, colorectal polyps, the precursor of most colorectal cancers, are nearly absent (2, 3). The age-standardized incidence rate per 100,000 population for colorectal cancer is 2.2; it is 18.7 for the local white population (4). Yet in African-Americans, the incidence rate of colon cancer alone, 32.8, is almost the highest in the world (5).

There have been reports of alterations in bowel behavior in local Africans, in regard of stool weight, defecation frequency, and whole gut transit time, although not fecal pH value (6, 7). Values are now intermediate between those previously observed in rural populations, and such reported in western populations. The dietary fiber intake of urban Africans has decreased from approximately 25–35 g (two generations ago) to 15–20 g daily (8). The staple cereal remains maize meal; however, it is usually refined (about 70% extraction rate). The intake of bread has increased, but this is mainly white bread. Additionally, because of their costs, consumption of vegetables and fruit are relatively low, about 2.5 helpings daily; *i.e.*, the diet is low in antioxidants. Yet, very importantly, although the dietary fiber content of maize meal has fallen, its content of “resistant” starch remains high, at 18 g/100 g (9).

Resistant starch fermentation produces more butyric acid than the fermentation of dietary fiber (10). Butyric acid is believed to reduce cancer risk by stimulating apoptosis, differentiation of cancer cells, and by inhibiting colon cancer cell invasion (10).

The large intestine is inhabited by a diverse population of anaerobic bacteria, which interact profoundly with the human host, thereby influencing his/her early development, quality of life, aging, and the promotion of a number of chronic degenerative diseases, including colorectal cancer (11).

The indigenous bacterial flora of the colon comprises about 400 different microbial species including bacteriodes, bifidobacteria, lactobacilli, and streptococci. The bacteria

ferment unabsorbed carbohydrate to short chain fatty acids (SCFA), which are rapidly absorbed and to the gases carbon dioxide, hydrogen, and methane. The role of the microflora in both the cause and prevention of colon cancer has provoked much debate. The protective role of butyrate suggests that manipulation of the flora by diet could help prevent colonic disease. In the normal fetus, the gastrointestinal tract is sterile up to birth. Subsequently, the colon becomes colonized with bacteria that it encounters from the environment. After 4 days, the flora present are dependent on the type of feeding; breast-fed infants have mostly bifidobacteria and lactobacilli, which produce mainly acetic and lactic acids, whereas formula-fed infants have flora more like that of the adult, which produces, at this stage, mainly acetic and propionic acids with very little butyrate (12, 13). The colonic flora matures slowly during weaning, and many bacterial metabolic activities do not reach adult levels until the age of 2 yr (14). The adult microflora, in contrast, are very stable unless disrupted by antibiotics or provided with very large doses of individual dietary fibers or starch (15, 16). In rats it has been shown that dietary fiber fed at weaning can influence the ability of the rat microflora to ferment that fiber in adult life (17). In African children it has been shown that, before the age of 3 yr, their microflora is able to ferment carbohydrate to SCFA more readily than is the case with white children (18, 19). The differences in the behaviors described may be due to qualitative and quantitative differences in their microflora and, in the case of African children, may be attributable to their higher intake of “resistant” starch.

Thus, the low occurrence of “Western” bowel diseases would seem due, in large part, to a diet with continuing high “resistant” starch content, associated with effective colonic microflora acquired in early infancy.

Accordingly, attempts to prevent bowel diseases should begin in early childhood, with emphasis on the role of the diet mentioned. Currently, about a one-fourth of African primary schoolchildren lie under the fifth centile of US NCHS Reference Standards for height and weight for age (1). It is noteworthy that it has recently been emphasized that excessive early energy intake has promotive consequences with regard to several major cancers (20). Furthermore, the view has been expressed that it is lesser energy intake, “but only early in life,” which is protective against the development of colon cancer (21).

As to the outlook, in developing populations, the proportion of the well circumstanced is very small, so that the masses of populations will continue to be relatively impoverished. Accordingly, undernutrition in childhood will continue, and possibly even worsen in some countries. In South-

ern Africa, dietarily, major reliance on maize as a staple food will continue. There is no likelihood of a rise in risk attributable to the consumption of red and processed meat (22).

The observations made raise the issue of why colon cancer remains very uncommon not only in other developing populations in Africa, but in those elsewhere. In the Gambia, in Western Africa, where the incidence of colon cancer is very low, mean daily intakes of carbohydrate foods by adult men have been reported to be 375 g starch and 25 g of nonstarch polysaccharides. However, the amount of resistant starch consumed daily was not determined (23). In Madras, India, colon cancer incidence is very low, at 1.5 per 100,000 (5). The staple cereal, rice, is reported to be low in nonpolysaccharide content (24). Unfortunately, its content of resistant starch was not reported, but may well be the protective factor. Clearly, more information is needed on the resistant starch content of the diets of the many populations who are at very low risk for colon cancer.

In brief, environmental factors that control colonic microflora in early childhood, linked with a diet high in resistant starch, are believed to be important factors in promoting a healthy large bowel in youth and later life. An additional protective factor may be undernutrition in childhood. It would seem that these are the primary factors responsible for the very low occurrence of colorectal adenomas in African populations.

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