

Comparison of Tropical and Temperate Zone Diarrheal Problems Leonardo Mata, SeD

Dr Mata points out that the tropics are now experiencing the diarrhea problems that were common in North America at the turn of this century: Very few pathogens or patterns of disease are unique to the tropics; the real problem is education and sanitation. The figures for the shedding of enteric virus or other pathogens will stagger the North American reader. -Editor

In the past, we thought there were differences between tropical and temperate zones in the etiology of intestinal diseases. Recent observations indicate that such differences do not exist. Infectious agents are ubiquitous. In general, diarrhea shows a much greater prevalence in the tropics, due to environmental conditions. With the exception of species requiring special habitats for maturation or completion of life cycles, practically all parasitic, bacterial, and viral agents associated with diarrheal disease are found worldwide. The rates of ameba and *Shigella* infection may be high in the arctic.

The main determinants of the exceedingly high incidence of intestinal infection in the tropics are poverty, deficient education, and poor environmental sanitation. These promote intestinal infection from [the moment of birth. North America and Europe had similar problems at the turn of the 20th century.

Labor and delivery in [the Indian population living in the Central and South American highlands occur at home without special preparation. Fecal contamination is a common occurrence and is conducive to infection of the newborn with pathogenic agents harbored by the mother. "Perinatal infection with parasites, enterobacteriaceae, and enteroviruses may occur in as high as 10% of such deliveries." Women delivering in clinics harbor fewer pathogens than their village counterparts. 3

If the infant receives colostrum and is adequately breast-fed, intestinal infections are rare and often asymptomatic. Breast-fed neonates shed *Shigella* organisms for a few days without clinical manifestations. The change to a mixed diet or to cow's milk results in a typical bout of dysentery. Pediatricians in the National Children's Hospital in Costa Rica successfully treat bacterial diarrhea with maternal milk. A similar phenomenon occurs with *Giardia*.

Infestation with *Dientamoeba fragilis*, *Balantidium coli*, and *Strongyloides stercoralis* are common, but they rarely cause disease. *Entamoeba histolytica*, *Giardia lamblia*, and *Trichuris* are more prevalent, but their relative importance with regard to bacteria and viruses has not been established.

The role of *E. histolytica* has been exaggerated in developing countries, as a result of inaccurate laboratory methods. Macrophages, leukocytes, and epithelial cells are often confused with amoeba trophozoites; also, shigellosis and other bacterial infections seem to obscure the appearance of trophozoites in the stool of asymptomatic carriers." Conversely, the role of *Giardia* has been underestimated (Table 1). Accurate diagnosis requires the upper small intestine. The first infection, acute, is followed by chronic diarrhea and may lead to chronic disease.

Of the enterobacteriaceae *Shigella* accounts for more than two thirds of all the diarrheal bacterial infections in the general tropical population. The rest are due to enteropathogenic *Escherichia coli*.

Prospective observation of children in their natural setting reveals an increasing incidence of *Shigella* and other offenders with age. Prevalence rates demonstrate the significance of the chronic carrier state. Twenty percent of children shed *Shigella* by 1 year of age.

Prevalence of Intestinal Parasites in a Cohort of 48 Children in the First 3 Years of Life

Parasite	% Prevalence
<i>E. histolytica</i>	3.2
<i>Giardia</i>	13.1
<i>Ascaris</i>	32.8
<i>Trichuris</i>	2.5

Until recently, the etiology of weaning diarrhea was unclear. *Shigella*, *Salmonella*, and enteropathogenic *E. coli* were found in no more than 20% to 40% of the patients. The characterization of toxigenic *E. coli* and the discovery of the rotaviruses are expected to raise the rate of etiologically explained cases significantly.

Recent studies have shown a high frequency of enterotoxigenic *E. coli* in children with diarrhea. Among hospitalized diarrheic children, 30% had stable toxin-producing *E. coli*, as opposed to 5% in control children." Enterobacteriaceae-containing plasmids resistant to a wide range of antibiotics were frequently found. In an outbreak of diarrhea in 10 neonates, *E. coli* resistant to ampicillin, chloramphenicol, and five other antibiotics was found in all patients. The resistances were plasmid-mediated." In general, multiple resistant bacteria are isolated in greater numbers from diarrheal cases than from controls.

Emeroviruses and adenoviruses are found in feces of infants shortly after birth. The intestine of young breast-fed infants is relatively resistant to these viruses, because specific antibodies are contained in human milk. Colostrum also contains antirotavirus globulins. Intestinal resistance to viruses wanes more rapidly than that against bacteria, so infection increases after 3 months; by age 1, most children shed viruses at frequent intervals" (Figure).

The significance of the rotaviruses and the 27-nm agents appears to be greater. These viruses are ubiquitous; in Costa Rica, they were found throughout 1976, but in low frequencies from March to October. In November the frequency of rotaviruses in diarrheal patients increased, producing a characteristic epidemic situation that extended until January 1977. Rotaviruses were found in more than 50% of unselected diarrheal cases during that period. 10

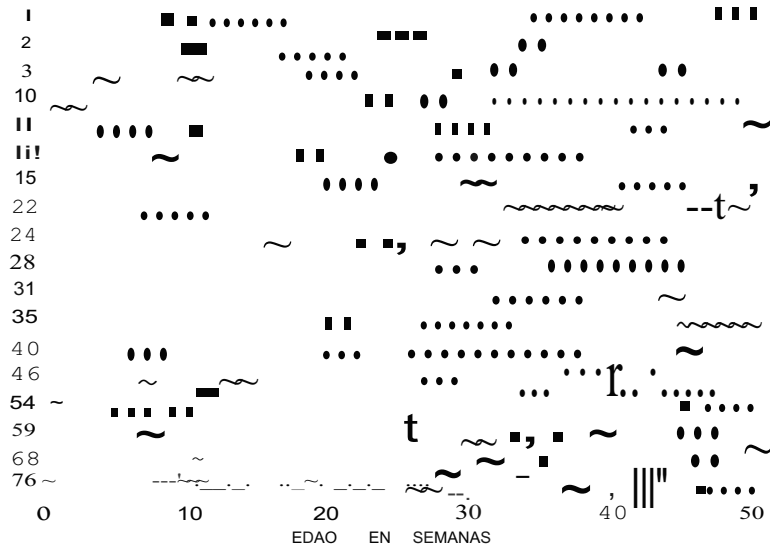


Figure. Life charts of 18 children cultured for viruses each week from birth (0-1 year of age). Each sphere represents an enterovirus; each triangle, a denovirus.

The seasonal variation seen in Costa Rica, a nation 10 degrees north of the Equator, is in agreement with observations in the United States, Canada, England, and Australia. It is difficult to explain seasonality in Costa Rica, a country in the tropics. However, the drop in the average temperature, particularly during the evenings, and a certain tendency of the population to crowd at the end of the year may provide the proper environment for the viruses.

Diarrheal infection with *Shigella*, *Salmonella*, or *E. coli* is an important cause of death, particularly in young children. The diarrhea associated with rotaviruses has a sudden and violent onset, with fever and vomiting in 10% of children. Leukocytes are present in the stools of 10% of the patients; erythrocytes, in 7%. Respiratory symptoms are observed in 20% of cases. It is easily manageable by prompt administration of fluid therapy, but, if rehydration is not undertaken, death may easily ensue.

Costa Rica, like several other developing nations, has shown a marked decrease in deaths due to diarrheal disease, attributed to remarkable improvement in the water supply and childhood nutrition. The most affected incidences were those of *Shigella* and the other bacterial agents, occurring with the rains.

No adequate control of the diarrheas of November to January has been effected yet. More children die from diarrhea in those months than in other months of the year, at the present time. The second peak of mortality in April and May marks the period of bacterial infections. Thus, rotaviruses could turn out to be an important cause of death in "winter" diarrhea.

Regarding Traveler's Diarrhea, the agents identified in diarrheal tourists are the same agents commonly found in the general indigenous population. A traveler may be an individual with little or no immunity to the prevailing agents that cause diarrhea if he comes from a highly sanitized environment. This is not

an entirely different experience from that of a child in a rural-area or slum in a developing nation. Both encounter a pathogen that they have not met and to which they have not yet acquired an immunity. The result is an episode of diarrhea.

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Discussion

DR HIRSCHHORN: Would you recommend giving metronidazole routinely to malnourished patients who have chronic diarrhea?

DR AMENT: In the United States. I believe that you ought not to treat unless you isolate the organism.

DR MATA: At least a third of all children with malabsorption are heavily colonized with *Giardia*. We have found one child, however, who had *Shigella flexneri* in the upper small bowel. Empirical therapy for *Giardia* would not have been good for him.

DR SCHNEIDER: We find no difference in the recovery rates, whether or not the children have *Giardia*. We are bothered by our frequent finding of heavy bacterial growth in the upper intestine. In addition to *E coli*; we also find *Salmonella* and *Shigella*.

DR OLARTE: At least 25% of our children with diarrhea in Mexico City have mixed infections. We do not know which organism is the "pathogen," or if organisms behave differently in combinations.

DR KLISH: Would you recommend treatment for the child who is totally asymptomatic in whom *Giardia* is found in routine screening procedures?

DR AMENT: If the patient has appropriate gastrointestinal symptoms and the parasite is found, it should be treated.

DR U.DALL: Is it possible to obtain a normal biopsy in a child who has severe malabsorption secondary to giardiasis?

DR AMENT: Yes, depending upon the biopsy site. We believe that reports of giardiasis with steatorrhea and normal biopsies just missed the mucosal lesions.

DR GABR: Dr Mara's findings are very similar to what we see in Egypt. Breast-milk is very effective in the prevention of infection and is less exposed to infection. Breast-feeding should be promoted in the developing countries.

DR MATA: We carefully examined breast-fed children to see if they were less exposed than other children. It is amazing how the fingers of the mothers or siblings get into the mouths of these children. There are many opportunities for these children to be infected.

DR DAVIDSON: I would like to mention the subject of candidiasis. Several reports implicate these organisms in the diarrheal syndrome. *Candida albicans* has been shown to depress lactase activity in the small intestine of infant rabbits (Bishop, et al: *J Med Microbiol* 7:259, 1974) and to be associated with depression of lactase activity in children with acute (Barnes, et al: *Acta Paediatr Scand* 63:423-46, 1974) and chronic diarrhea (Kozinn, et al: *Pediatrics* 30:71, 19(2) or after surgical correction of congenital intestinal anomalies (Bishop, et al: in *Proceedings, Pediatric Surgical Congress*, Melbourne, Royal Children's Hospital, vol 2, pp 170-182). The pathogenesis of the lesion caused by this organism remains unexplained. Abundant abnormal growth of *Candida* species has also been found in culture of intestinal contents from malnourished children with chronic diarrhea.