

ORIGINAL RESEARCH

Nutrition and the human gut microbiome: Gut health status among children with compromised water, sanitation and hygiene in Siaya County Kenya

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Abstract

Gut health is crucial for overall well-being, especially in early childhood. The gastrointestinal tract is essential for nutrient absorption, immune function, and maintaining a balanced internal environment. Poor gut health can lead to malnutrition, stunted growth, and increased infection susceptibility. Among the conditions affecting gut health, Environmental Enteric Dysfunction (EED) is particularly concerning for young children in low- and middle-income countries. EED involves chronic inflammation of the small intestine, resulting in increased gut permeability, nutrient malabsorption, and systemic inflammation. Although often asymptomatic, EED significantly affects child growth and development, making early detection and intervention critical. Water, sanitation, and hygiene (WASH) practices play a pivotal role in maintaining gut health. Inadequate WASH conditions can exacerbate the risk of EED by exposing children to pathogens that trigger intestinal inflammation and damage. In regions like Siaya County, Kenya, compromised WASH practices are prevalent, leading to a higher incidence of EED among children. This study evaluated gut health in children aged 12-15 months in Siaya County, focusing on the impact of compromised WASH conditions. Two diagnostic methods were used: the Dual Sugars Lactulose to Rhamnose Ratio (LRR) test and the 13-Carbon Sucrose Breath Test (13CSBT). In a cross-sectional analytical design, 100 children were selected with Study County selected purposively and simple random sampling for study children. An LRR value above 1.69 indicated EED positivity, while a value below indicated EED negativity. The results showed that 53% of the children were EED positive, with significant differences in LRR and rhamnose recovery between EED positive and negative groups. The 13CSBT measured gut permeability via ¹³CO₂ recovery after ingestion of ¹³C-labeled sucrose. The test showed low ¹³CO₂ recovery rates, indicating reduced sucrase activity, consistent with LRR results. A paired t-test found significant differences in ¹³CO₂ recovery at baseline and 90 minutes. However, Pearson correlation analysis revealed no significant association between 13CSBT CPDR at 90 minutes and LRR, lactulose, or rhamnose levels, suggesting the tests might not be directly comparable. Despite limitations with the 13CSBT, the findings highlight the prevalence of EED in the study group and underscore the importance of addressing WASH practices to manage undernutrition and improve health outcomes in children. Addressing poor WASH conditions is essential for enhancing gut health and overall well-being in vulnerable populations.

Key Words: Gut health, EED, water sanitation and hygiene, Dual sugars, 13-Carbon Sucrose Breath Test