Infant feeding practices and probiotics effects on nutritional recovery and morbidity of severely malnourished infants in Democratic Republic of Congo

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Richard Mbusa Kambale

Institut de Recherche Expérimentale et Clinique, Université Catholique de Louvain, Brussels, Belgium; Université Catholique de Bukavu, Faculté de Médecine, Bukavu, République Démocratique du Congo

Promoter: Dimitri Van der Linden, Cliniques Universitaires Saint Luc, department of pediatric infectious diseases, Brussels, Belgium

richkambale7@gmail.com

Keywords

Infant feeding practices; malnutrition; diarrhea; nutritional recovery; probiotics.

Abstract

Severe Acute Malnutrition (SAM) is a major public health concern. Recent evidence has shown that dysbiosis leads to malnutrition and recurrent infections. Several interventions targeting the gut microbiota, including probiotics, have emerged as promising treatment. We assessed infant and young child feeding (IYCF) practices, infectious diseases experienced by children with SAM, and the effect of probiotics on the pneumonia, diarrhea, and nutritional recovery in children with SAM in Democratic Republic of Congo. IYCF practices were suboptimal; the main infectious diseases of children with SAM were pneumonia, diarrhea, bacteremia and malaria; probiotics reduced the number of days with diarrhea, if any, and the risk of diarrhea in children aged 16 months and older; a higher proportion of children receiving probiotics reached nutritional recovery after 6 weeks, but at 12 weeks, no effect was found. Optimization of mother-child nutrition, microbiological surveillance of children with SAM, and implementation of local probiotic-based foods may improve the survival of children with SAM.

Background

Malnutrition is a major public health concern, affecting around 45 million children worldwide. Malnutrition increases incidence, severity and case fatality of common infections, and underlying 35% of all child deaths globally. Recent evidence has shown that malnutrition is not due to food insecurity alone, but reflects a combination of factors, including an important role of the gut microbiota, which fails to develop properly during the first two years of life in malnourished children. Dietary interventions alone are insufficient to comprehensively reduce the burden of child malnutrition and fail to address the persistent infectious burden of the disease. With the advancement in knowledge of the key role of gut microbiota disruption in childhood malnutrition, several interventions targeting the gut microbiota have emerged as promising treatment modalities.

This thesis aimed to (i) assess infants' feeding practices in a general population sample from South Kivu; (ii) identify the main infectious diseases experienced by children with severe acute malnutrition (SAM) and, (iii) assess the effect of probiotics on the main childhood killer infectious diseases (pneumonia and diarrhea), and on nutritional recovery in children with SAM

Methods

The thesis reports the results of four studies: two cross-sectional studies, one systematic review with meta-analysis, and one randomized controlled trial (RCT) (1, 2, 3, 4). Except for the systematic review, all studies were conducted in South Kivu province, (eastern Democratic Republic of Congo (DRC)), in 3 Health Zones: Ibanda (urban area) and Kabare (rural area) Health Zones for the first cross-sectional study; and Kadutu Health Zone (urban area) for the second cross-sectional study and the RCT. Selection of these Health Zones was based on demographic, epidemiological, accessibility, and logistical criteria.

In the first cross-sectional study assessing infants' feeding practices in urban and rural areas of South Kivu, the sample size was 750 mother-infant's pairs (375 in each area). The second study assessed the main infectious diseases experienced by children with SAM. An exhaustive sampling was used. The systematic review included 15 RCTs. Finally, in the 4th study assessing the effect of probiotics on diarrhea, pneumonia and nutritional recovery, the sample was 400 infants (200 in probiotics group and 200 in placebo one). The study was performed in accordance with the principles in the Declaration of Helsinki of 1975 as revised in 1983. Children were enrolled after verbal and written consent had been provided by their caregivers. Caregivers were made aware of their right to withdraw from the study at any time. Ethical approval was granted by the Université catholique de Bukavu Ethics Committee (Bukavu/DRC, UCB-CIES 01-05/2020) and the Comité d'Ethique hospitalo-Universitaire of the Université catholique de Louvain and Cliniques Universitaires Saint-Luc (Brussels/Belgium, 04-01-2021).

Findings

Main findings are summarized as follows:

- Less than 30% of infants consumed flesh foods, dairy products, eggs, fruits and vegetables, predominantly in rural areas.
- The rate of minimum acceptable diet was 33%.

- Mothers living in urban area [Adjusted Odds Ratio (AOR) 2.39; 95% CI 1.43, 3.85], those who had postnatal care visits (AOR 1.68; 95% CI 1.12, 2.97), those with secondary or post-secondary education level (AOR 1.83; 95% CI 1.20, 2.77), and those with good household socioeconomic level (AOR 1.72; 95% CI 1.14, 2.59) were more likely to give recommended minimum acceptable diet compared to their counterparts.
- Pneumonia (16%), bacteremia (6%), gastroenteritis (5%) and malaria (5%) accounted for 32% of confirmed diagnosis in children suffering from SAM.
- For children suffering from diarrhea, the number of days of disease was lower in probiotics [4.11 (95%CI: 3.37, 4.51)] compared with placebo group [6.68 (95%CI: 6.26, 7.13)] ($p<0.001$).
- For children aged 16 months or older, the risk of diarrhea was lower in probiotics [75.6% (95%CI: 66.2, 82.9)] compared with placebo group [95.0% (95%CI: 88.2, 97.9)] ($p<0.001$), but no significant difference of the risk for the youngest.
- In probiotics group, nutritional recovery happened earlier: At the 6th week, 40.6% of the infants were waiting for nutritional recovery, contrasting with 68.7% of infants in placebo group; but the nutritional recovery rate at the 12th week was similar between groups.
- Probiotics had no effect on pneumonia incidence.

Conclusions

Our thesis research has shown that the minimum acceptable diet rate remained low among infants, especially among mothers with low school attendance and those non-attending prenatal care. As part of nutrition optimization among those at risk, the nonadherence to minimum acceptable diet should urgently be addressed through appropriate and widespread counseling.

This thesis further demonstrates an increased incidence of pneumonia, gastroenteritis, bacteremia and malaria among children with SAM. Since data are lacking on pathogens and their antimicrobial susceptibility in children with SAM in DRC, future research should fill this gap to distinguish children with SAM who require antimicrobial therapy and the type of antimicrobial that is appropriate.

Finally, this PhD research has shown that probiotics significantly reduced the number of days of diarrhea, the risk of diarrhea in older infants (>16 months), and the time to reach nutritional recovery. Future research is needed for economic analysis of scaling up probiotic's use nationally and internationally, and exploration of local microbiota-directed complementary foods.

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