

Improving Nutritional Status and CD4 Counts in HIV-Infected Children through Nutritional Support

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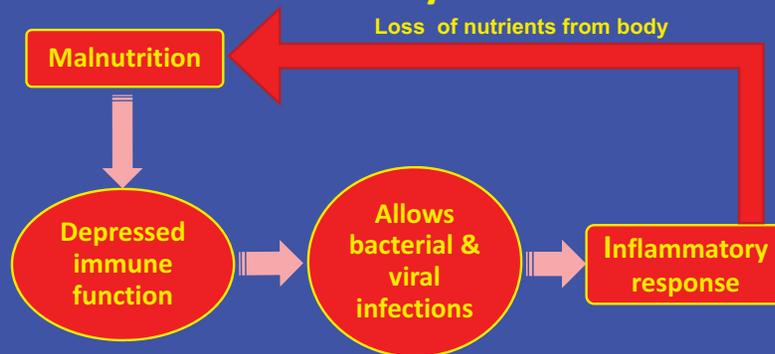
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Background

- Malnutrition is the primary cause of immunodeficiency worldwide. Children 5 – 60 mo suffer the greatest insult to the immune system due to a higher incidence of malnutrition at this age.
- Insufficient intake of macronutrients or certain micronutrients leads to a decrease in immune function and to an increase in infectious diseases in children.

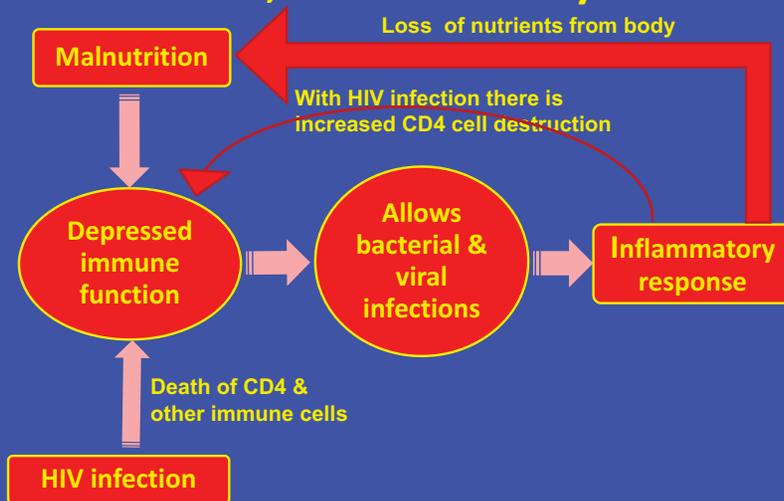
Interrelationship of Malnutrition and Immune system



Background

- Young children with HIV are 2.5 – 4 times more likely to die than their counterparts who are not infected.
- HIV is considered to be the primary cause for more than a third of the deaths in children under the age of five years.

Interrelationship of Malnutrition, HIV Infection, and Immune system



Background

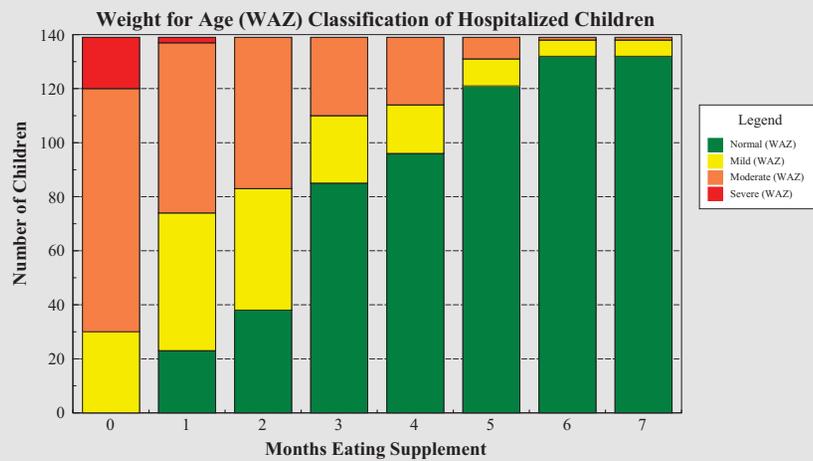
- There are approximately 2 million HIV-infected children less than 15 yr of age in the world and 90% of these children live in sub-Saharan Africa.
- These HIV-infected children are innocent victims – more than 90% of the infections occur during pregnancy, birth or breastfeeding.



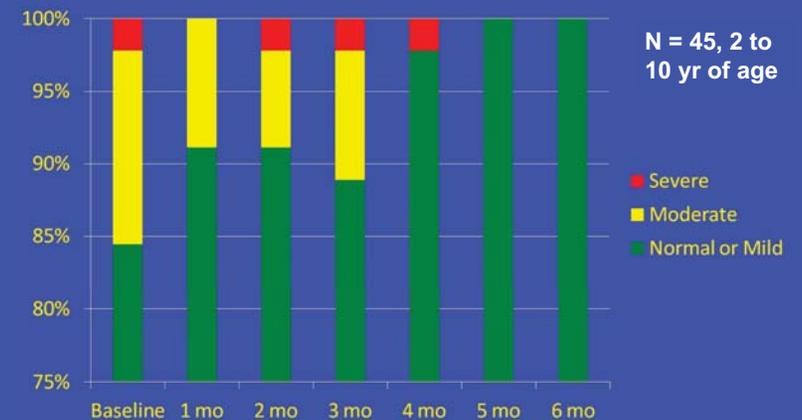


Background

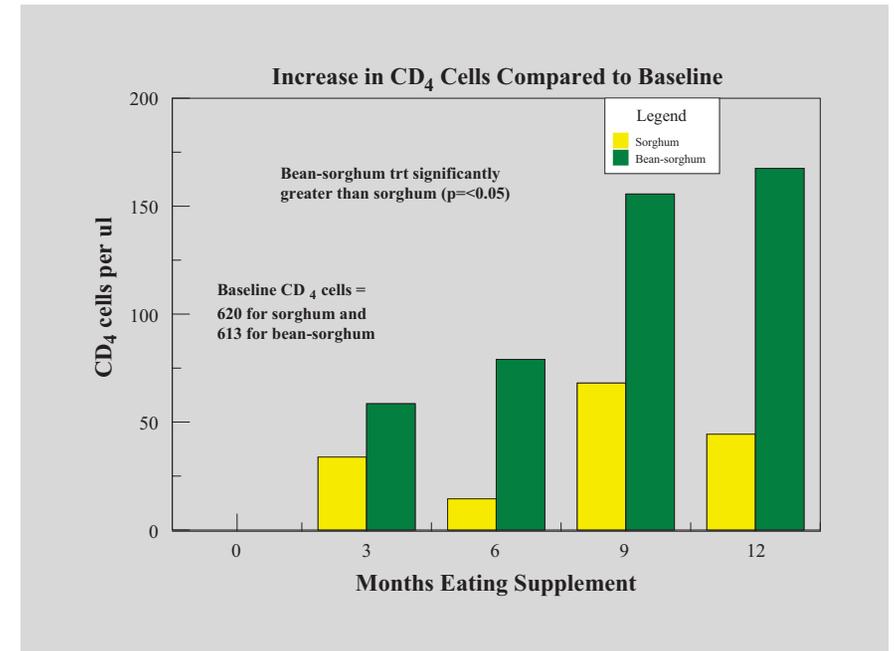
Previous studies conducted by our group



Extent of Underweight in HIV+ Children



Improved Immune Status of HIV infected Children



Questions to be answered by the current study

- Was the improvement in CD4% observed in the previous studies due to eating beans or will any protein source reproduce the positive effects?
- Will eating a food supplement allow the CD4 cell count to remain elevated for at least 24 mo?

Questions to be answered by the current study

- What is the relative cost of nutrition intervention compared to ART?
- How does eating the bean-based supplement promote an increase in CD4 cell count?

Study Locations

- The study is being conducted in rural areas in three districts located 125 km from SUA and in the Rombo district near the Kenya/Tanzania border (600 km from SUA)
- A total of 586 HIV-infected, ART naïve children are enrolled into the study.

Distribution of children in supplement groups

Type of supplement	No. of Children
Bean-based	195
Cowpea-based	197
Sardine-based	194

Experimental Procedures

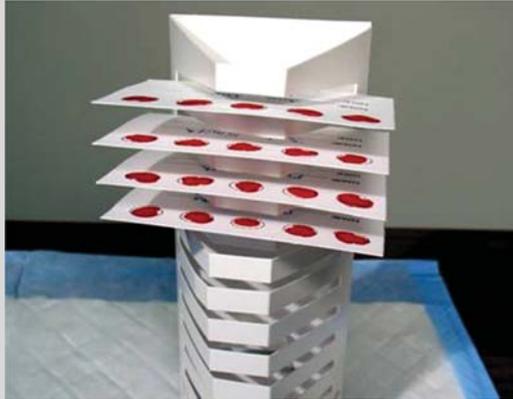
- Venous blood was collected from each child at baseline and every 3 mo thereafter
- The blood sample was analyzed for hemoglobin and by flow cytometry for CD4 and CD8 cell counts.





Experimental Procedure - Preparation of dried blood spots (DBS)

40 μ L aliquots of blood are dispensed onto Whatman 903 “protein-saver paper”, dried, stored, and shipped to the US for analysis of biomarkers of inflammation (acute phase proteins, interleukins, cytokines) and other markers of interest.



Food Supplements

- Children started receiving the food supplement after the baseline data were gathered.
- One hundred g of supplement provides 100% of the adult RDI for minerals and vitamins, 80 - 100% of the RDI for protein and 60 – 100% of the RDI for calories depending on the age/size of the child.

Preparation, packaging and distribution of food supplement

- 150,000 packages (20,000 kg) of extruded and fortified supplementary foods have been prepared, packaged and partly distributed to the children through the CTC centers.
- The food supplements are sealed in small airtight polyethylene bags which contain 130 g – a daily allotment.
- Home based care providers visit the children daily to ensure that the food supplement is consumed.





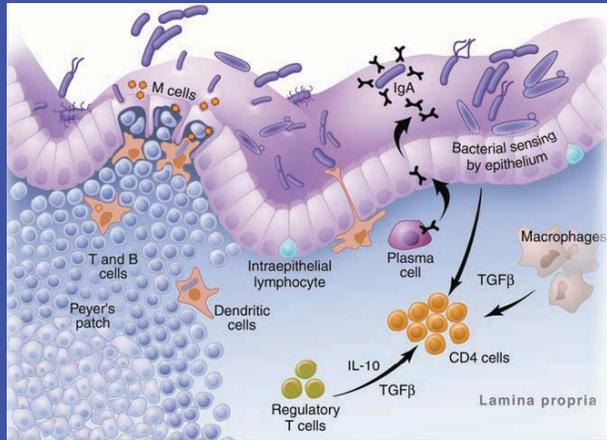
Determination of relative cost of nutritional supplement versus ART

A comparative study to determine the costs associated with nutritional supplementation versus drug (ART) treatment has started and data collection is continuing.

How can Eating Beans Improve the Immune Status of HIV+ People?

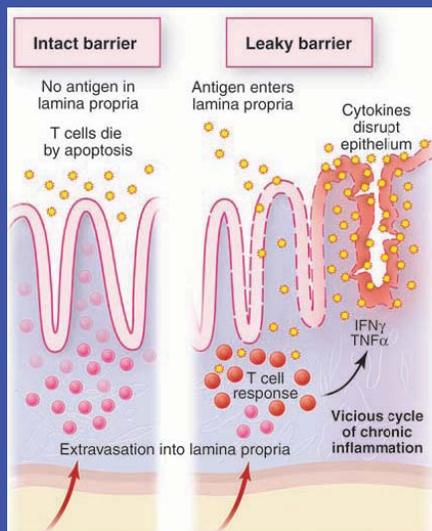
Brief background

1. The surface area of the GI tract is equal to a football field.
2. > 70% of our immune cells are located in the intestinal mucosa to prevent commensal flora and dietary antigens present in the gut lumen from getting into the circulatory systems.



After MacDonald & Monteleone, Sci 307:1922,2005

In the early stages of HIV-infection, most of the CD4 cells in the intestine are killed by the virus which greatly reduces the ability of the immune system to prevent entrance of commensal flora and dietary antigens into the circulatory systems which sets off a vicious cycle of chronic inflammation in the intestine.



Chronic inflammation facilitates destruction of CD4 cells by the virus and promotes nutrient depletion. Current drug treatment does not restore the number of CD4 cells in the intestinal mucosa and it doesn't eliminate chronic inflammation of the GI mucosa either.

After MacDonald & Menteleone, Sci 307:1924,2005

We know from our other studies that if the intestinal lining is damaged, eating beans improves the intestinal barrier to bacteria and reduces chronic inflammation.

We hypothesize that eating beans reduces chronic inflammation in the intestine of HIV-infected individuals which in turn allows an increase in CD4 cell number (improved immune system) in both the intestinal mucosa and blood.