

# THERAPEUTIC FOOD SUPPLEMENTS THAT PROMOTE HEALTHY GUT MICROBIOME TO TREAT MALNUTRITION

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## Technology Description

Prof. Jeffrey Gordon and his colleagues have developed an inexpensive food formulation that could treat malnutrition and a range of associated health problems by repairing the gut microbiome. Children who are malnourished are currently treated with supplemental nutrition that provides calories but does not prevent long term consequences related to growth, immune function and neurodevelopment. In addition, the gut microbiome of these children is perturbed compared to healthy children. There is evidence that these microbiome differences are causally linked to the problems with growth and development. The goal of this technology, called “Microbiota-Directed Complementary Food” (MDCF), is to provide calories as well as “bioactive” ingredients from food to promote a healthy microbiome. Then the repaired microbiome could counteract and prevent the longer term effects of malnutrition.

Furthermore, the initial MDCF formula was discovered using a novel computational model. This platform could be used to identify additional formulations optimized to treat other disorders that affect the microbiome or to design snacks and supplements that promote and sustain healthy microbiomes in individuals of all ages.

## Stage of Research

The inventors designed a Microbiota Directed Complementary Food (MDCF) formulation made from chickpea flour, soy flour, banana and peanut flour. In a randomized double-blind study of malnourished children (comparing MDCF to standard supplemental food), they demonstrated that after 1 month of treatment this MDCF:

- repaired the microbiome (so it resembled healthy, age-matched controls); and
- dramatically increased biomarkers of growth, bone formation, neurodevelopment and immune function.

## Applications

- **Prevention and treatment for malnutrition** - current MDCF formulation could be used to treat malnutrition or prevent it in children who are transitioning to solid foods
- **General nutrition/snacks** – MDCFs could be used to promote or sustain healthy microbiomes in individuals of all ages
- **Nutrition formulation discovery platform** – computational workflow, metrics and animal models used to design the initial MDCF candidate could be used to identify follow on ingredients and formulations for different geographic locations or to repair microbiomes in adults recovering from

other conditions

## Key Advantages

- **Treats persistent side effects of malnutrition** – MDCFs have beneficial effects to regulate host systems involved in healthy growth:
  - promotes healthy microbiome growth in addition to providing calories and nutrients
  - increases biomarkers of growth, development and immune function
- **Locally produced and affordable** – MDCF ingredients are inexpensive and easy to source

## Publications

- Gehrig, J. L., Venkatesh, S., Chang, H. W., Hibberd, M. C., Kung, V. L., Cheng, J., ... & O'Donnell, D. (2019). [Effects of microbiota-directed foods in gnotobiotic animals and undernourished children](#). *Science*, 365(6449), eaau4732.
- Raman, A. S., Gehrig, J. L., Venkatesh, S., Chang, H. W., Hibberd, M. C., Subramanian, S., ... & Petri, W. A. (2019). [A sparse covarying unit that describes healthy and impaired human gut microbiota development](#). *Science*, 365(6449), eaau4735.
- [For malnourished children, new therapeutic food boosts gut microbes, healthy development](#). theSource July 11, 2019.

## Patents

- Provisional application pending

## Website

- [Gordon Lab](#)