

# The Validation of Blood-Based Biomarkers: Lipopolysaccharide Binding Protein (LBP)

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## ABSTRACT

Chronic undernutrition is a major global health burden affecting one in every five children around the world, leaving them more vulnerable to infection and increasing their risk of mortality. A major contributor to the global burden of undernutrition is Environmental Enteric Dysfunction (EED), a condition which results from exposure to unsafe water.

Three biomarkers will be validated to assess for EED. LBP, a biomarker for intestinal permeability, will be measured using the highly portable sampling technique of dried blood spot (DBS) collection. In this procedure, five drops of blood are collected from a finger stick.

Analysis of the three biomarkers and lifestyle surveys of participants will develop an extensive image of illness in the individual. Through this, it is possible to comprehensively evaluate the health status of an individual and eventually correlate this to risk of malnourishment in low-resource communities.

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## BACKGROUND

- Chronic undernutrition represents a significant global health burden affecting millions of children worldwide. Countless studies have demonstrated that chronic malnutrition, particularly when experienced in the first 1,000 days of life, has significant short- and long-term effects on health and human capital [3].
- Reduced nutrient absorption, caused by the condition Environmental Enteric Dysfunction (EED), appears to play a significant role in the etiology of malnutrition. EED is a subclinical condition, affecting an individual without presenting overt symptoms [3].
- There is a lack of effective methods of measurement, EED has remained relatively understudied on a large scale. Existing methods are highly invasive and resource-intensive [5].
- DBS technology, in which drops of whole blood are collected onto filter paper following a simple finger stick, is a minimally invasive and highly portable method of studying EED. Low-cost and field-friendly, DBS will better facilitate the study of EED in low-resource settings where the condition is most prevalent and harmful [5].
- Blood-based biomarkers markers, including transferrin, I-FABP, and LBP have demonstrated associations with altered growth outcomes in young children. As such, these biomarkers must be investigated for use as biomarkers of EED through DBS technology.

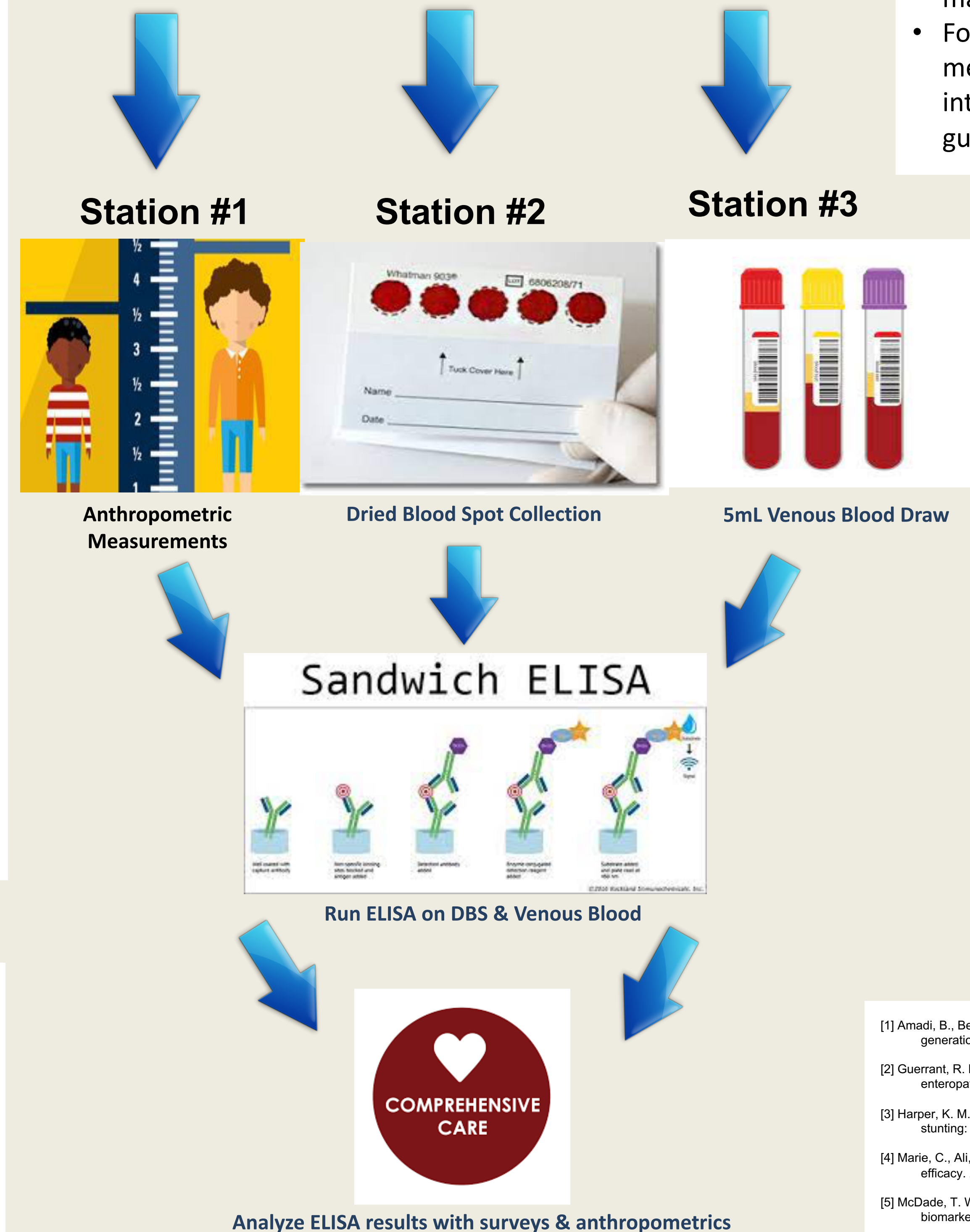
## OBJECTIVES

**Aim 1:** Identify and other blood-based biomarkers of EED for measurement from DBS and develop optimized protocol for their analysis.

**Aim 2:** Complete a matched DBS/venous blood comparison study for candidate biomarkers of EED.

## METHODS

- Optimize three commercial ELISA kits to establish reliability.
- Recruitment of Penn community members for 1-time participation through flyers and word-of-mouth.
- Run Stations illustrated below
- Administer qualitative survey to minimize confounding variables and understand participant lifestyles.



## LBP as a Biomarker

- Lipopolysaccharide Binding Protein (LBP) is a component of bacterial cell walls and may be measured to gauge bacterial translocation [1].
- In adults with EED, intestinal permeability has been correlated to LBP plasma concentrations [2].
- LBP is used as a biomarker for systemic inflammation, relating to abnormal immune responses or infections indicative of malnutrition [4].
- For the purposes of the investigation, LBP concentrations measured against I-FABP concentrations (a biomarker of intestinal damage) may offer a dynamic image of an individual's gut health.

## COMPREHENSIVE CARE

- Many physiological conditions may be viewed as the convergence of smaller abnormalities, such as systemic inflammation, intestinal damage, and/or iron deficiencies in the case of EED. In summation, smaller root causes of EED may be contributing to the sweeping diagnosis of "malnutrition."
- Comprehensive analysis delves into synergistic causes of illness to develop far-reaching research initiatives and resulting treatment plans.

## FUTURE STEPS

- With successful validation of LBP and the other biomarkers of interest, this same protocol may be used in low-resource settings abroad to detect EED
- A range of validated EED biomarkers allows for a more a comprehensive view of the condition and may help draw more concrete correlations between EED and malnutrition.

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