Examing the Double Burden of Malnutrition in Rural Indian Children and Evaluating the Effectiveness of a Comprehensive School Based Intervention in Addressing the Burden
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Abstract
Objective: The aim of the study is to assess the prevalence of stunting and obesity, their behavioral and environmental correlates and to evaluate the effectiveness of a comprehensive school-based dietary intervention in preventing under/over nutrition among children in rural India.

Theory, Prior Research, and Rationale: This study will use the socioecological model as a theoretical foundation. The paradoxical co-occurrence of under and over nutrition (double burden) is an emerging public health concern among children in India. Childhood is one of the most critical and formative periods of human life and a growing body of evidence has indicated that adequate nutrition is crucial for optimizing both physical and mental development. Research also shows that nutritional knowledge regarding healthy food choices is limited in India. Implementing a comprehensive multi-level intervention in a school environment might be an effective strategy since schools offer a unique opportunity to reach children on a large scale.

Description and Evaluation: Target audience are the school, parents and children (ages 10-15 years) who will receive a nutrition education intervention in the school setting. After assessment of nutritional status of each child, a multi-level assessment will be done to examine school policies, parents and children’s behavior/attitudes related to diet, physical activity and screen time and develop a comprehensive school-based intervention program. Outcome measures will include knowledge/behavior change from one year of pre to post intervention, anthropometric changes as well as changes in school wellness policies.

Conclusions and Implications: Findings of this study will provide insights into the prevalence and factors associated with under and over nutrition among schoolchildren and reveal the effectiveness of multi-level intervention approaches used (such as targeting factors at home and school environment) in prevention of the double burden of malnutrition. We expect that the nutrition education intervention will enable desirable behavioral changes related to diet, physical activity and screen time. Wellness policies implemented by the school will support behavioral changes.

Introduction
Childhood under and over nutrition is a growing burden in low and middle income countries. Rapid economic development and urbanization have given rise to a Nutritional Transition, whereby energy-dense, high caloric snack foods and sweet beverage consumption replace high fiber diets. Sedentary lifestyle lead to an increase in obesity and diet-related chronic diseases. The coexistence of under and over nutrition, a phenomenon known as “double–burden” poses a new health challenge in developing countries resulting in risk factor for diseases. The coexistence of undernutrition and overnutrition, a phenomenon known as “double–burden” poses a new health challenge in developing countries resulting in risk factor for diseases. The coexistence of undernutrition and overnutrition, a phenomenon known as “double–burden” poses a new health challenge in developing countries resulting in risk factor for diseases.

Expected Outcomes
After assessment and utilization of the comprehensive school based intervention program from pre-intervention to one year post intervention we anticipate beneficial behavior and diet changes resulting in:

Successful implementation of the comprehensive school based intervention
Changes in school policies and environment supporting behavioral changes
Improvement in quality of school lunches
Improvement in nutritional quality of snacks brought from home
Increased play or physical activity and reduced screen time at home and in school
Long-term improvements in BMI and lower adiposity

Preliminary Conclusions
We expect that the multi-level intervention program will enable desirable behavioral and lifestyle changes related to overall diet, increased physical activity and reduced screen time.

Theoretical Model

Proposed Multi-Level Framework of Socioecological Model for Addressing Childhood Obesity

- Good nutrition
- Promotes child and family health
- Addressing malnutrition is essential to achieve the sustainable development goals
- Nutrition is critical to both health and economic development
- Improves school education and performance
- Supports stronger immune systems
- Reduces the risk of disease
- Focus and investment for integrated solutions will tackle malnutrition in all its forms

Understanding the Double Burden of Malnutrition is characterized by the Coexistence of:
1. Undernutrition (wasting, stunting, & micronutrient deficiencies) along with overweight and obesity
2. Diet-related noncommunicable diseases
3. Within individuals, households and populations
4. Throughout life