TREATMENT OF ANEMIA WITH IRON-FORTIFIED RICE IN A SCHOOL LUNCH PROGRAM IN BURUNDI

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Introduction
The World Health Organization estimates one quarter of all school-age children and nearly half (48%) of developing-country school-age children are anemic (WHO 2001, WHO 2008). Anemia can be the result of one or multiple etiologic pathways, including micronutrient-deficient diets, acute blood loss due to hookworm or malaria (Brooker et al. 2007), and other infectious agents that the body reacts to by reducing dietary iron absorption and storing blood iron as ferritin instead of forming hemoglobin (Finberg 2013).

Iron-only fortified rice has previously proven to significantly improve the hemoglobin concentrations of women and children (Hotz et al. 2008, Moretti et al. 2006, Radhika et al. 2011).

Objective
To evaluate the efficacy of using multiple- micronutrient fortified rice (iron, zinc, thiamine, folic acid) to improve the hemoglobin concentration and anemia prevalence of anemic schoolchildren (7-11 years) in rural Burundi.

Methods

Figure 1. Study outline and flow of participants.

Study design
Randomized controlled trial
Eligibility criteria:
• Schoolchildren (7-11 years old)
• Anemic (Hb 7.0 g/dl-11.9 g/dl) (1500m)
• Albendazole received 2 weeks prior to enrollment

The school lunch program was supported by commodities provided by the World Food Programme (WFP).
• 5 days per week for 7 months
• Lunch ration: Rice (150 g), beans (40 g), vitamin A-fortified vegetable oil (10 g), and salt (3 g)
• Multiple-micronutrient formulation provided: iron (17.8 mg), zinc (8.5 mg), thiamine (1.8 mg), and folic acid (600 mg)

This study was approved by the PATH Research Ethics Committee and the Comité National d’Ethique du Burundi.

Data collection
Hemoglobin test (HemoCue® Hb 201+): Demographic and household information, dietary diversity (24 hours), and recent child health status

Results

Table 1. Characteristics of study participants, by receipt of intervention.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Control (n = 443)</th>
<th>Intervention (n = 461)</th>
<th>Total (n = 904)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>8.8 (1.4)</td>
<td>8.9 (1.4)</td>
<td>8.9 (1.4)</td>
</tr>
<tr>
<td>Female</td>
<td>55.3%</td>
<td>51.1%</td>
<td>53.1%</td>
</tr>
<tr>
<td>Missed 2 weeks of school or more</td>
<td>10.7%</td>
<td>11.7%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Mean socioeconomic status quintile</td>
<td>3.0 (1.4)</td>
<td>3.0 (1.0)</td>
<td>3.0 (1.0)</td>
</tr>
<tr>
<td>Latrine access</td>
<td>99.1%</td>
<td>98.9%</td>
<td>99.0%</td>
</tr>
<tr>
<td>Recent fever</td>
<td>48.5%</td>
<td>48.0%</td>
<td>48.3%</td>
</tr>
<tr>
<td>Dietary diversity (mean score)</td>
<td>2.0 (0.8)</td>
<td>1.9 (0.8)</td>
<td>1.9 (0.8)</td>
</tr>
<tr>
<td>Number of recently consumed iron-rich foods (0-6+)</td>
<td>4.1 (1.2)</td>
<td>3.8 (1.1)</td>
<td>4.0 (1.2)</td>
</tr>
</tbody>
</table>

Dietary diversity was defined as categorization from moderate anemia at baseline to mild/no anemia at follow-up, or from mild at baseline to no anemia at follow-up.

The change in anemia category was evaluated using a logistic mixed model. Improvement was defined as recategorization from moderate anemia at baseline to mild/no anemia at follow-up, or from mild at baseline to no anemia at follow-up.

The change in Hb was evaluated between the intervention and control groups using a linear mixed model; restricted maximum likelihood estimates were calculated due to a small numbers of clusters.

Conclusions
Multiple-micronutrient fortified rice containing iron, zinc, thiamine, and folic acid did not significantly improve hemoglobin concentration or anemia prevalence among schoolchildren in rural Burundi.

The high prevalence of infection, as evidenced by fever, among the children may have contributed to the nonsignificant change.

Acknowledgments
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References