Smart Food in Tanzania: Pilot study to make healthier and cost-effective school meals

Current situation and challenges:
- Despite progress in improving nutrition, protein malnutrition and nutritional anaemia remains very high in Tanzania
- Tanzania is one of the largest producers of pigeonpea (multipurpose drought tolerant, protein rich legume which also enriches soil fertility due to nitrogen fixing capacity)
- Pigeonpea is not only a vital source of income for smallholder farmers, but a potential source of protein for families and source of fodder for livestock
- Tanzania’s annual production of pigeonpea is approximately 200,000 metric tonnes, 80% of which used to be exported to India as whole grain. This reliance on export exposes farmers to high risk, as seen with the restrictions on pigeonpea imports by India since 2017, leaving farmers with excess stock and low domestic demand to buy the produce
- Pigeonpea consumption is low despite the need for protein to be included in diets of rural and urban poor, which is dominated by maize and cassava
- Low production and consumption of nutritious and climate resilient cereals like sorghum and calcium rich finger millet
- Maize is the most produced food crop. In the arid regions more suited to like sorghum and calcium rich finger millet

What needs to be done next?
- The project outcomes support a call to scale this out to other schools
- Train further schools to adapt nutritious recipes for their student populations
- Train and support schools to enable crop access and safe storage
- Reinforce this study with a detailed clinical trial on the nutritional benefits of the different meal combinations

Proposed solution: Nutrition education and diversified school meals
The Smart Food project in Tanzania was designed to test a solution to tackle the lack of market for pigeonpea, sorghum and millet. These come under the definition of Smart Food as they are good for you, the planet and the farmer. The project selected four residential schools with a total target of 2000 high school students to implement a nutrition education training and diversify the school meals composition to include pigeonpea and finger millet recipes (partially substituting beans with pigeonpea, and maize ugali porridge with finger millet porridge). Outcomes were measured for economic, social and nutrition impact.

Project design and implementation
Consultation and key partners included: The Prime Minister’s office, Ministry of Education, Ministry of Health, Tanzania Agricultural Research Institute (TARI) - Selian, Export Trading Group (ETG - Farmers Foundation working with farmers to build their capacities to produce more and profitably) and Agricultural Markets Development Trust (AMDT - A trust working to develop agricultural value chains to improve livelihoods of farming communities)

3 main questions were tested:
- Did the students accept the changes in school meals?
- Did the Smart Food meals make economic sense?
- Did the changed recipes improve the nutritional value of the school meals?

Savings per meal means more budget for extra fruit/vegetable to further improve nutrition

<table>
<thead>
<tr>
<th>School A</th>
<th>School B</th>
<th>School C</th>
<th>School D</th>
</tr>
</thead>
<tbody>
<tr>
<td>99388</td>
<td>41700</td>
<td>97200</td>
<td>19800</td>
</tr>
</tbody>
</table>

Cost reduction for the school (Tsh)
19,800 - 99,388 = significant savings
(Ts$ 8.5 - 42) per meal depending on number of students in the school and the volume of beans they consumed prior to intervention

Economic impact of changing school meals to include locally available pigeonpea

Challenges faced during implementation:
- Access to fresh pigeonpea – parents prefer the fresh green pigeonpea which cooks quicker and tasted better in their view
- Increased demand for pigeonpea = increase in prices which then affect the school budget
- Insect damage in stored pigeonpea
- Cost and availability of crushed groundnuts which students like in the recipe
- Cost of finger millet
- Changing mindsets on school meals (this was addressed through nutrition awareness training)

How to address some of the challenges:
- Get improved pigeonpea varieties for school meals supply
- Increase training on recipes and sensitize other schools
- Farmers use safe storage methods to prevent insect damage like triple layer bags

POTENTIAL NEW MARKET FROM SCHOOLS NATIONWIDE
700 metric tonnes of pigeonpea per week = $300,000
140 metric tonnes of sorghum/millet per week = $200,000

Insight #1

Key Partners

School Locations: 2 in Babati and 2 in Kondoa. Sites were selected due to existing projects to support farmers growing legumes and sorghum/millet.

- Student population: 2000 high school students in total
- Baseline: Project analysed existing diets, perceptions and food budgets
- Previous school meal: Pure maize meal porridge, maize ugali with boiled beans, rice with boiled beans, fruit/vegetable twice a week
- New school meals: Mixed maize meal/finger millet porridge, pigeonpea stew with peanut butter served with maize, pigeonpea stew with peanut butter served with rice, fruit/vegetable twice a week
- Baseline Perceptions: Pigeonpea is bitter, smells bad, not good for mental health etc

Student population: 2000 high school students in total

Baseline: Project analysed existing diets, perceptions and food budgets

Previous school meal: Pure maize meal porridge, maize ugali with boiled beans, rice with boiled beans, fruit/vegetable twice a week

New school meals: Mixed maize meal/finger millet porridge, pigeonpea stew with peanut butter served with maize, pigeonpea stew with peanut butter served with rice, fruit/vegetable twice a week

Baseline Perceptions: Pigeonpea is bitter, smells bad, not good for mental health etc

## School staff received training on new recipes and students were given nutrition awareness education

District level nutrition officers from the Ministry of Health and chefs trained school cooks on recipes with sorghum, millet and pigeonpea. Recipes included finger millet porridge, pigeonpea with groundnut and with coconut milk.

Students were educated on nutrition values of foods and importance of diversity.

- **87%** Students changed perceptions and food choices
- **91%** Wanted pigeonpea in school meals
- **98%** Wanted finger millet or sorghum porridge

## School meals were changed: Pigeonpea was offered 2 times a week and finger millet 2 - 7 times a week

School meals were previously reliant on maize and beans purchased from outside local area as the region is too arid to grow these crops.

Pigeonpea is grown by local farmers usually for export. India's restrictions on pigeonpea imports had left farmers with surplus harvests, which was now bought by the schools. Calcium-rich finger millet is also grown in the region.

## Recipes used in the study

<table>
<thead>
<tr>
<th>Meal</th>
<th>Recipe</th>
<th>Average intake/child</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>Finger millet porridge</td>
<td>300 ml</td>
</tr>
<tr>
<td>Lunch</td>
<td>Pigeonpea stew with peanut butter served with maize</td>
<td>250 to 300 grams</td>
</tr>
<tr>
<td>Dinner</td>
<td>Pigeonpea stew with peanut butter served with rice</td>
<td>250 to 300 grams</td>
</tr>
</tbody>
</table>

## Nutrition comparison of previous and revised school meals

As the schools are residential, children eat breakfast, lunch and dinner there. The previous menu included ugali (maize meal) with beans, Makande (beans with maize) and rice with beans. This study used finger millet, pigeonpea, vegetables, peanut butter and maize to formulate recipes. Students’ average nutrient intake was compared before and during the study intervention and summarized in the table below.

The Tanzania food composition table (Lukmajni et al., 2008) was used to calculate the nutrient value of recipes consumed before and during intervention. Each food item consumed by the students was calculated from dietary assessment which gave an average nutrient consumption per day for each child.

Though the students ate three main meals per day before the intervention, the calorie intake, and intake of protein and major micronutrients, especially iron and calcium, was low during baseline as shown in table below. These students were adolescents who especially need more nutrients as they are in a critical growth period when nutrients, in particular, micronutrients (iron and calcium), along with protein and calories, are essential.

## Baseline nutrient value Vs nutrient value of Smart Food recipes provided at school

<table>
<thead>
<tr>
<th></th>
<th>Average Nutrient intake</th>
<th>Energy (Kcal)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Calcium (mg)</th>
<th>Iron (mg)</th>
<th>Zinc (mg)</th>
<th>Magnesium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 School average</td>
<td>898.78</td>
<td>30.65</td>
<td>8.29</td>
<td>101.64</td>
<td>7.05</td>
<td>5.44</td>
<td>341.16</td>
<td></td>
</tr>
<tr>
<td>New recipe</td>
<td>1541.00</td>
<td>71.90</td>
<td>22.15</td>
<td>572.69</td>
<td>18.90</td>
<td>12.07</td>
<td>627.11</td>
<td></td>
</tr>
</tbody>
</table>

## Nutrient Value of Baseline Recipes Vs New Recipe

### Energy (Kcal)

![Graph showing comparison of energy intake between baseline and new recipes.](image)

### Protein (g)

![Graph showing comparison of protein intake between baseline and new recipes.](image)

### Fat (g)

![Graph showing comparison of fat intake between baseline and new recipes.](image)

### Calcium (mg)

![Graph showing comparison of calcium intake between baseline and new recipes.](image)

### Iron (mg)

![Graph showing comparison of iron intake between baseline and new recipes.](image)

### Zinc (mg)

![Graph showing comparison of zinc intake between baseline and new recipes.](image)

### Magnesium (mg)

![Graph showing comparison of magnesium intake between baseline and new recipes.](image)
School Locations: 2 in Babati and 2 in Kondoa. Sites were selected due to existing projects to support farmers growing legumes and sorghum/millet.

Student population: 2000 high school students in total.

Baseline: Project analysed existing diets, perceptions and food budgets.

Previous school meal: Pure maize meal porridge, maize ugali with boiled beans, rice with boiled beans, fruit/vegetable twice a week.

New school meals: Mixed maize meal/finger millet porridge, pigeonpea stew with peanut butter served with maize, pigeonpea stew with peanut butter served with rice, fruit/vegetable twice a week.

Baseline Perceptions: Pigeonpea is bitter, smells bad, not good for mental health etc.

School staff received training on new recipes and students were given nutrition awareness education.

District level nutrition officers from the Ministry of Health and chefs trained school cooks on recipes with sorghum, millet and pigeonpea. Recipes included finger millet porridge, pigeonpea with groundnut and with coconut milk.

Students were educated on nutrition values of foods and importance of diversity.

87% Students changed perceptions and food choices.

91% Wanted pigeonpea in school meals.

98% Wanted finger millet or sorghum porridge.

School meals were changed: Pigeonpea was offered 2 times a week and finger millet 2 - 7 times a week.

School meals were previously reliant on maize and beans purchased from outside local area as the region is too arid to grow these crops.

Pigeonpea is grown by local farmers usually for export. India’s restrictions on pigeonpea imports had left farmers with surplus harvests, which was now bought by the schools. Calcium-rich finger millet is also grown in the region.

Recipes used in the study:

<table>
<thead>
<tr>
<th>Meal</th>
<th>Recipe</th>
<th>Average intake/child</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>Finger millet porridge</td>
<td>300 ml</td>
</tr>
<tr>
<td>Lunch</td>
<td>Pigeonpea stew with peanut butter served with maize</td>
<td>250 to 300 grams</td>
</tr>
<tr>
<td>Dinner</td>
<td>Pigeonpea stew with peanut butter served with rice</td>
<td>250 to 300 grams</td>
</tr>
</tbody>
</table>

Nutrition comparison of previous and revised school meals:

As the schools are residential, children eat breakfast, lunch and dinner there. The previous menu included ugali (maize meal) with beans, Makande (beans with maize) and rice with beans. This study used finger millet, pigeonpea, vegetables, peanut butter and maize to formulate recipes. Students’ average nutrient intake was compared before and during the study intervention and summarized in the table below.

The Tanzania food composition table (Lukmajni et al., 2008) was used to calculate the nutrient value of recipes consumed before and during intervention. Each food item consumed by the students was calculated from dietary assessment which gave an average nutrient consumption per day for each child.

Though the students ate three main meals per day before the intervention, the calorie intake, and intake of protein and major micronutrients, especially iron and calcium, was low during baseline as shown in table below. These students were adolescents who especially need more nutrients as they are in a critical growth period when nutrients, in particular, micronutrients (iron and calcium), along with protein and calories, are essential.

Baseline nutrient value Vs nutrient value of Smart Food recipes provided at school:

<table>
<thead>
<tr>
<th>Average Nutrient intake</th>
<th>Energy (Kcal)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Calcium (mg)</th>
<th>Iron (mg)</th>
<th>Zinc (mg)</th>
<th>Magnesium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 School average</td>
<td>898.78</td>
<td>30.65</td>
<td>8.29</td>
<td>101.64</td>
<td>7.05</td>
<td>5.44</td>
<td>341.16</td>
</tr>
<tr>
<td>New recipe</td>
<td>1541.00</td>
<td>71.90</td>
<td>22.15</td>
<td>572.69</td>
<td>18.90</td>
<td>12.07</td>
<td>627.11</td>
</tr>
</tbody>
</table>

Baseline nutrient value Vs nutrient value of Smart Food recipes provided at school:

<table>
<thead>
<tr>
<th>Average Nutrient intake</th>
<th>Energy (Kcal)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Calcium (mg)</th>
<th>Iron (mg)</th>
<th>Zinc (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 School average</td>
<td>898.78</td>
<td>30.65</td>
<td>8.29</td>
<td>101.64</td>
<td>7.05</td>
<td>5.44</td>
</tr>
<tr>
<td>New recipe</td>
<td>1541.00</td>
<td>71.90</td>
<td>22.15</td>
<td>572.69</td>
<td>18.90</td>
<td>12.07</td>
</tr>
</tbody>
</table>

Baseline nutrient values compared to baseline values:

- Energy: 1541.00 Kcal vs 898.78 Kcal
- Protein: 71.90 g vs 30.65 g
- Calcium: 572.69 mg vs 101.64 mg
- Iron: 18.90 mg vs 7.05 mg
- Zinc: 12.07 mg vs 5.44 mg
- Magnesium: 627.11 mg vs 341.16 mg
Smart Food in Tanzania: Pilot study to make healthier and cost-effective school meals

Current situation and challenges:
- Despite progress in improving nutrition, protein malnutrition and nutritional anaemia remains very high in Tanzania
- Tanzania is one of the largest producers of pigeonpea (multipurpose drought tolerant, protein rich legume which also enriches soil fertility due to nitrogen fixing capacity)
- Pigeonpea is not only a vital source of income for smallholder farmers, but a potential source of protein for families and source of fodder for livestock
- Tanzania’s annual production of pigeonpea is approximately 200,000 metric tonnes, 80% of which used to be exported to India as whole grain. This reliance on export exposes farmers to high risk, as seen with the restrictions on pigeonpea imports by India since 2017, leaving farmers with excess stock and low domestic demand to buy the produce
- Pigeonpea consumption is low despite the need for protein to be included in diets of rural and urban poor, which is dominated by maize and cassava
- Low production and consumption of nutritious and climate resilient cereals like sorghum and calcium rich finger millet
- Maize is the most produced food crop. In the arid regions more suited to like sorghum and calcium rich finger millet

Challenges faced during implementation:
- Access to fresh pigeonpea – parents prefer the fresh green pigeonpea which cooks quicker and tasted better in their view
- Increased demand for pigeonpea = increase in prices which then affect the school budget
- Insect damage in stored pigeonpea
- Cost and availability of crushed groundnuts which students like in the recipe
- Cost of finger millet
- Changing mindsets on school meals (this was addressed through nutrition awareness training)

How to address some of the challenges:
- Get improved pigeonpea varieties for school meals supply
- Increase training on recipes and sensitize other schools
- Farmers use safe storage methods to prevent insect damage like triple layer bags

What needs to be done next?
- The project outcomes support a call to scale this out to other schools
- Train further schools to adapt nutritious recipes for their student populations
- Train and support schools to enable crop access and safe storage
- Reinforce this study with a detailed clinical trial on the nutritional benefits of the different meal combinations

Proposed solution: Nutrition education and diversified school meals
The Smart Food project in Tanzania was designed to test a solution to tackle the lack of market for pigeonpea, sorghum and millet. These come under the definition of Smart Food as they are good for you, the planet and the farmer.
The project selected four residential schools with a total target of 2000 high school students to implement a nutrition education training and diversify the school meals composition to include pigeonpea and finger millet recipes (partially substituting beans with pigeonpea, and maize ugali porridge with finger millet porridge). Outcomes were measured for economic, social and nutrition impact.

Insight #1

Potential new market from schools nationwide
- 700 metric tonnes of pigeonpea per week = $300,000
- 140 metric tonnes of sorghum/millet per week = $200,000