

9 Improved household nutrition through home-grown produce and consumption of nutritious and healthy products

Seetha Anitha, Victor Afari-Sefa, Zione Kalumikiza, Khumbo Mhango, Inviolata Moshia, Yasinta Muzanila, Agnes Mwangwela, Justus Ochieng, Patrick Okori, and Takuji W. Tsusaka

Introduction

Undernutrition causes stunting, underweight, and wasting, and these are major health issues throughout Africa, adversely affecting the physical and mental growth and development of children. High rates of stunting are seen throughout East and Southern Africa (ESA), with rates of 34% and 26% in the Africa RISING project countries of Malawi and Tanzania (MoHCDGEC *et al.*, 2016; NSO and ICF, 2017). Micronutrient deficiencies (e.g., iron, zinc, and calcium), described as hidden hunger, remain rife in both countries, especially among women of reproductive age, infants, and young children. These deficiencies have significant consequences for maternal and child health, mortality, the global burden of disease, and economic development. In Malawi, for example, it is estimated that child undernutrition resulted in economic losses equivalent to 10.3% of gross domestic product in 2012. To this end, the Government of Malawi has reviewed its nutrition policy to redirect the national focus on nutrition programming and align its goals with the Malawi Growth and Development Strategy III (Government of Malawi, 2018). Tanzania has also shown commitment to addressing undernutrition by articulation of the National Nutrition Strategy (United Republic of Tanzania, 2016). Both national policies recognize the need for

multi-sectoral approaches to address malnutrition by promoting dietary diversity.

A dietary approach needs to target the key growth window of opportunity in children, particularly between 6 and 23 months of age, when growth is rapid and at risk of faltering when nutrition is lacking (Ferguson *et al.*, 2015). This coincides with the weaning period and is an ideal time to introduce affordable, acceptable, and nutrient-rich foods.

Dietary diversity can be improved through both nutrition-specific and nutrition-sensitive agricultural interventions. Nutrition-specific interventions address the immediate causes of undernutrition, i.e., inadequate diets and illnesses caused by nutrient deficiency. Nutrition-sensitive interventions incorporate nutrition objectives in wider disciplines; for example, advice on producing crops and varieties that are rich in nutrients, and improved post-harvest processing and storage to minimize loss and improve quality and nutritional composition.

Cereals are the staple foods providing energy; legumes are a major inexpensive source of protein; green leafy vegetables are a rich source of minerals and vitamins (such as iron, vitamin A, vitamin K, and folate); yellow and orange vegetables are a rich source of vitamin A; and animal products such as eggs and dairy are a rich source of protein, fat, and minerals. These food

groups in combination provide all the nutrients required for human growth and development.

While the earlier chapters of this book provide information on including nutrient-rich crops in small-scale farming systems, nutrient-sensitive interventions do not automatically provide appropriate nutrition. Food preparation methods can be vital to maximizing the nutrient content of food. This chapter therefore provides information on various meals based on home-grown products or locally available ingredients. It presents recipes and practices to support child nutrition through: a) packaged integrated technologies for improved child nutrition; b) household processed milk products; and c) vegetable-based formulations.

Packaged integrated technologies for improved child nutrition

Description of the technology

Africa RISING validated a package of integrated technologies by working with 118 mothers and their children, who were aged 6–23 months. The technologies included health-related guidance on the importance of breastfeeding, personal hygiene, and food safety; education on nutrition regarding different food groups; and nutrition-sensitive food preparation using local products.

Hygiene is important in improving nutritional status as it eliminates infection and consequent diarrhea. It is important to address diarrheal diseases, which kill millions of children each year, with even those who survive often experiencing malnutrition, leading to developmental delay. Simple basic hygiene practices can be integrated with nutrition training programs. These involve hand washing after using a toilet and before eating or feeding children, using clean utensils for cooking and feeding, keeping the eating surroundings clean, and boiling water for drinking. Food preparation advice includes how to prepare raw ingredients, safe cooking, heating before consumption, and safe storage of food to avoid microbial contamination.

Improved hygiene was tracked and resulted in a significant reduction in the number of cases of diarrhea. Food safety messages focused on preparing contamination-free crop and livestock

products. Most contamination results from improper crop handling during harvesting, processing, and storage (Anitha *et al.*, 2017). See [Chapter 7](#) of this book for more information.

The study validated a method of preparing improved baby food (porridge), with training on associated hygiene, food safety, and nutrition. Acceptance of the newly introduced baby food was evaluated by measuring the food left over (the amount not eaten by the child) and consumption behavior based on children's mood and actions while eating (crying, smiling, spitting, swallowing, etc.). The porridge includes maize, millet, legumes, leafy vegetables, and carrots, and was accepted by over 95% of the mothers with no leftovers after consumption ([Figure 9.1](#) and [Table 9.1](#)). The porridge was fed to children for 21 days with periodic measurements of height, weight, and mid-upper arm circumference (MUAC) to identify the impact on nutritional status. The mothers received hands-on experience in preparing the recipe for the children throughout the training period.

Benefits of the technology

Practical sessions on hand washing, boiling and storing water, and maintaining cleanliness of vessels before feeding the children were provided through 'learning by doing' with 118 mothers in Kongwa and Kiteto districts of Tanzania over a period of 21 days. Thereafter, the mothers continued the practices on their own



Figure 9.1. Porridge (300 g) made from ingredients listed in [Table 9.1](#). (Photo courtesy of Anitha Seetha, 2020.)

and were monitored for 60 days. Hygiene status was monitored by recording incidences of diarrhea and infection. By following these simple personal hygiene methods, infections are reduced gradually within the first 10 days. The incidence of diarrhea remained high until the seventh day of nutrition intervention, and then gradually declined to 25% by day 21 (Anitha *et al.*, 2019). Feeding the porridge to the children in adequate quantities improved their growth in terms of weight and MUAC within a short time (Table 9.2).

The major benefits of the technology package are:

- Improved dietary diversity without extra expense, with products sourced from home-grown cereals, legumes, and fresh vegetables.
- Reduced incidence of diarrhea within 10 days following adoption of appropriate hygiene practices.
- Increased quality of the food with contamination reduced by 80% through practicing better post-harvest crop management.

- Improved overall nutrition, with impacts on cases of low weight and wasting.

Opportunities for adoption

The recipe was accepted by 95% of the children and can be adapted for use across ESA, where crop production and diets are similar. Porridges are liked by all age groups and often served in schools as breakfast, but mostly with a single ingredient. This makes the porridge monotonous and lacking in essential nutrients. The mixed-ingredient, nutritious porridge could therefore be introduced in school feeding programs to enhance nutrient intake among schoolchildren.

Several commercial porridge flours with single ingredients are available. This suggests there is scope to modify the formulations for processing by microprocessors, and small- and medium-scale enterprises, thereby improving both nutrition for consumers and market opportunities for farmers.

Table 9.1. Ingredients of a nutritious porridge fed to 118 children aged 6–23 months

Ingredient	Food group	Quantity	Nutrient category
Maize	Cereal	25 g	Carbohydrate
Finger millet	Cereal	25 g	Micronutrients (calcium, iron, magnesium, and zinc)
Soybean	Legume	25 g	Protein
Pigeonpea	Legume	15 g	Protein
Amaranth	Green leafy vegetable	50 g	Micronutrients
Carrot	Vitamin A-rich vegetable	50 g	Vitamin A
Iodized salt		For taste	Iodine
Vegetable oil		A tablespoon	Fat

Note: Nutrient content (quantity per 100 g): Energy – 478 kcal, Protein – 19.4 g, Fat – 21.8 g, Calcium – 330 mg, Iron – 6.8 mg, Zinc – 3.0 mg.

Table 9.2. Benefits of feeding nutritious porridge to 118 children.

Child growth indicator	Indicator status		
	Baseline	Endline	% change
Underweight (%)	17.8	3.6	–80
Stunting (%)	40.0	40.0	0
Wasting (%)	6.0	0	–100
Diarrhea (%)	67.8	19.8	–71
Aflatoxin exposure (%)	71.9	10.0	–86

How to get started

Preparation.

- Sort the cereals and legumes to remove contamination and wash them in clean water.
- Sun dry the cereals and legumes and then grind each component separately into fine powder.
- Measure the cereals and legumes flour, mix thoroughly according to the quantities given in [Table 9.1](#).
- The mixed flour can be stored for one month in an airtight container.

Cooking.

- Heat 750 ml or three cups of water to a lukewarm temperature.
- Pour the warm water into a bowl with 100 g or one cup of flour mixture and stir well to make sure there are no lumps.
- Heat this mixture and keep stirring until the mixture boils.
- Leave the mixture to boil for 20–30 minutes (or until it is cooked properly) and add one tablespoon of oil.
- Boil separately one cup of fresh amaranth leaves (50 g) in 250 ml of water, mash it, and add it to the boiling mixture.
- Add 50 g of grated fresh carrots to the boiling mixture.
- Add salt to taste. This recipe will result in a semi-solid porridge, which should be used within one day to avoid contamination. It is always best practice to consume after cooking; however, if there is any porridge leftover, it should be kept in a closed container and heated again before eating.

Feeding suggestions.

- The complementary porridge is not suitable for children younger than six months.
- For a six-month-old infant, feed two teaspoonfuls of the porridge twice a day (around 20 g/day), along with breastfeeding.
- Increase the quantity gradually: for children of eight months feed three to four teaspoonfuls twice a day, along with breastfeeding.
- For children over eight months, feed at least three times a day (100 g per day) along with other snack foods and breastfeeding.
- Larger amounts of this porridge can be given in the complete absence of breast milk.

- This porridge will also benefit older children in the household, although they are able to receive their nutrients from other sources.
- Hygiene and sanitation should be maintained throughout food preparation and feeding. This includes washing all the ingredients appropriately before using, cooking the porridge in a clean pot, washing hands before starting food preparation, washing utensils for food preparation and feeding, washing hands with soap before feeding, boiling water and cooling it to room temperature before giving to the child, and keeping all the utensils covered.
- Make sure all the ingredients used for preparing the porridge are of good quality (remove rotten, damaged, and discolored grains).

Household processed milk products

Description of the technology

Dairy products are rich in protein, fat, calcium, and vitamin D. Processing milk to produce fermented products such as yoghurt and coagulated milk (e.g., paneer) enhances the nutrient value. Africa RISING introduced four new milk-based products enriched with fruit and vegetables to provide additional vitamins and minerals and improve dietary diversity. Practical training sessions were conducted for 31 milk producers on how to make carrot milk, fruit milkshakes, yoghurt, and yoghurt smoothies (with 29 people completing the final assessment). The banana yoghurt smoothie was the most popular, being prepared up to three times a week by at least 50% of caregivers. A daily intake of 200–250 ml/day is recommended for children aged six months to five years.

Benefits of the technology

The technology package consisting of four recipes was promoted over nine months among dairy farming households in Dedza district of Malawi. The recipes improved dietary nutrient intake, with the number of children under five years that were underweight reducing from 10% to 5% and no wasting observed. This is

crucial for long-term growth and development. Table 9.3 summarizes the benefits on health indicators of consuming one or more of the new recipes each day. Farmers and caregivers responded positively to the training on improved nutrition, with increased awareness of different milk products and their nutritional benefits. Nearly all women (96.7%) accepted the new technologies and more milk was consumed as a drink at home among children aged under five years.

Opportunities for adoption

The nutrition education approach increased awareness and knowledge of alternative milk processing and dietary diversity among milk producers, with the increased home consumption of milk, suggesting a higher likelihood of the recipes being adopted. The milk products could also be introduced to households keeping dairy goats, further increasing the scope for potential adoption.

Table 9.3. Benefits on health indicators in Dedza district, Malawi

Health indicator	Impact of nutrition recipes	
	Baseline	After feeding for nine months
Underweight (children under five years, %)	9.5 (41) ¹	5.1 (39)
Wasting (children under five years, %)	0 (41)	0 (39)
Food security (Household Food Insecurity Access Scale) ² (%)	48.4 (31)	53.3 (29)
Children receiving adequate dietary protein (%)	73.7 (31)	98.2 (29)
Children receiving adequate dietary calcium (%)	2 (31)	23.6 (29)
Children receiving adequate dietary phosphorus (%)	44.5 (31)	90 (29)
Children receiving adequate dietary zinc (%)	27.7 (31)	84.5 (29)
Children receiving adequate dietary vitamin A (%)	33 (31)	92.5 (29)
Female caregivers practicing the technologies (%)	3.2 (31)	96.7 (29)
Children receiving ≥ 250 ml of milk per day (%)	51.6 (31)	89.7 (29)
Daily average milk production/yield (l)	9.9 $\pm$ 5.6 (31)	16.2 $\pm$ 9.5 (29)
Daily average milk quantity sold (l)	9.1 $\pm$ 6.6 (31)	14.4 $\pm$ 8.85 (29)
Market participation (% of milk production sold on daily basis)	91.9	88.9

¹Values in parentheses are the numbers of children/caregivers for which data were collected.

²Coates *et al.* (2007).

How to get started

Carrot milk

• Ingredients

- 6 medium size carrots
- 1 l of milk

• Preparation

- Peel carrots and pound in a mortar using a pestle until fully crushed.
- Add 250 ml water to the carrot mash and sieve the juice.
- Set up a double boiling set, i.e., a small pot with 1 l of milk placed inside a bigger pot holding water. The bigger pot is then placed on the heater. Keep stirring the milk to avoid formation of a skin on the surface.



Continued

Continued.

- Add 1 cup (250 ml) of carrot juice to the milk and leave to boil for 2 minutes to cook the carrot and release vitamin A.
- Add sugar or honey as desired to sweeten the drink and serve when cold.
- **Serving suggestion**
- Serve as a beverage in between meals, at 200–250 ml per day per individual (both children and adult).
- **Additional notes**
- Non-starchy orange-fleshed sweetpotato can also be used for this recipe.
- Special utensils to have include a sieve, mortar and pestle, one smaller pot that can fit inside a bigger pot.
- Carrot enriches milk with vitamins A, B6, C, K, and potassium.
- Boiling kills harmful microorganisms in milk and helps to cook the carrot.



Carrot slices (top) are ground into juice and added to boiling milk (middle). Serve as a beverage when ready (bottom). (Photos courtesy of Agnes Mwangwela, 2020.)

Fruit milkshakes

Ingredients

One cup of milk

Seasonal fruits e.g., banana, avocado, pawpaw, mango

Sugar or honey (optional)

Preparation

1. Wash and peel the fruit. Mash in a container with a wooden spoon or pound in a mortar with a pestle until smooth.
2. For banana, avocado, and pawpaw, gradually add one quarter of a cup of mashed fruit to one cup of cold pasteurized milk in a container while crushing the remaining lumps until smooth.
3. For mango, sieve the mashed fruit in a porous plastic colander to remove the fibers. Add one quarter of a cup of the mango fruit juice with one cup of cold pasteurized milk in a container and mix.
4. Sugar or honey can be added if desired.



Continued

Continued.

Serving suggestion

- Serve as a beverage in between meals, 250 ml per day per individual (both children and adults).

Additional notes

- Do not use overripe fruits to ensure food safety.
- Special utensils to have include a mortar, pestle, and sieve or colander.
- Mangoes enrich the milk with vitamins A, B6, C, and E, and folate, iron, zinc, and a little calcium.



Ripe mangoes and pasteurized milk (top) are the main ingredients for preparing a mango milkshake (bottom). (Photos courtesy of Agnes Mwangwela, 2020.)

Yoghurt

Ingredients

- 1 l of milk
- 1 teaspoon of plain yoghurt

Preparation

1. Boil the milk.
2. Strain using a clean cloth.
3. Cool the milk to a warm temperature (40°C) in a container.
4. Add 1 teaspoon of plain yoghurt and stir.
5. Leave the mixture covered at room temperature for 6–8 hours.

Serving suggestion

- Serve as a beverage in between meals, 250 ml per day per individual (both children and adults).

Additional notes

- Feed yoghurt to children with sugar or honey.
- For additional nutrients and taste, the yoghurt can be mixed with fruit.

Yoghurt smoothies

Ingredients

- Plain yoghurt
- Ripe fruits in season (banana, avocado, pawpaw, mango)

Preparation

1. Wash and peel the fruit. Mash in a container with a wooden spoon or pound in a mortar with a pestle until smooth.
2. For banana, avocado, and pawpaw, gradually add half a cup of mashed fruit to one quarter of a cup of yoghurt in a container while crushing the remaining lumps until smooth.



Yoghurt served in a bowl. (Photo courtesy of Agnes Mwangwela, 2020.)

Continued.

3. For mango, sieve the mashed fruit in a porous plastic colander to remove the fibers. Add half a cup of the mango fruit juice with one quarter of a cup of yoghurt in a container and mix.

4. Add one quarter of a cup of sweet orange juice and sugar or honey if desired to sweeten.

Serving suggestion

- Serve as a beverage in between meals, 250 ml per day per individual (both children and adults).

Additional notes

- Do not use overripe fruits to ensure acceptable taste and food safety.
- Special utensils to have include a mortar, pestle, and sieve or colander.
- Bananas enrich the yoghurt with vitamins B6 and C, potassium, manganese, and magnesium.



Banana yoghurt smoothie. (Photo courtesy of Agnes Mwangwela, 2020.)

Vegetable-based formulations

Description of the technology

Consumption of vegetables throughout the year improves dietary quality and diversity, and helps combat micronutrient malnutrition. Vegetables enrich a cereal-based diet with nutrients that are essential for health, including vitamins A and K, folate, iron, zinc, sodium, potassium, and magnesium. Most households in ESA grow a range of traditional vegetables that are adapted to local growing conditions, including amaranth, cowpea leaves and pods, African nightshade, spider plant, and African eggplant. All these are rich in minerals and vitamins, with some providing more vitamins and minerals than non-traditional vegetables. Households are also growing an increasing range of exotic vegetables such as carrots, tomatoes, and onions. These are useful to enhance the taste, color, and nutrient content of food, since carrots are rich in vitamins, minerals, and fiber; and tomatoes and onions are good sources of vitamin C and antioxidants.

Training rural communities on the nutritional value of vegetables creates awareness, encourages consumption, and benefits household nutrition and health, with new recipes providing greater choice. Africa RISING introduced several new recipes made with traditional but underutilized African vegetables (pumpkin, eggplant, nightshade, jute mallow, amaranth,

and blackjack). It was recommended that people consume at least five types of vegetables per day with a daily consumption of around 250 g/day for an adult, 200 g/day for children aged 14–17 years, and 125 g/day for children aged 4–13 years. The products presented here are based on the vegetables introduced to small-scale farm households by Africa RISING in Tanzania.

Benefits of the technology

The vegetable-based recipes were evaluated with 257 farmers, with 171 attending training on how to prepare the different recipes. The training used participatory methods to create a good level of acceptance and maintain cultural dignity. The results showed that the training encouraged people to increase their consumption of vegetables, with up to 252 g being consumed per person per day. This is above the minimum intake recommended by the World Health Organization, which is 240 g (WHO, 2003). Nutrition training increased the consumption of vegetables among male-headed households by 96% and among female-headed households by 71%. The average consumption per person was higher among the trained and untrained female-headed households than among their male counterparts (Table 9.4). This gender differential reflects the importance traditionally placed by women on nutrition.

Table 9.4. Benefits resulting from nutritional training and consumption of vegetables

Benefit	Nutrition training category		% change
	Not participated (n = 86)	Participated (n = 171)	
Vegetable consumption per capita (g/day)	115	252	119
Number of different vegetables consumed per day	3	5	60
Vegetable consumption per capita (g/day) in female-headed households	205 (16)	350 (51)	71
Vegetable consumption per capita (g/day) in male-headed households	114 (70)	210 (120)	96

Note: Values in parenthesis represent the total number of female- and male-headed households in the group.
Source: Africa RISING data and Jape (2017).

The number of different vegetables consumed increased as a result of the knowledge acquired. Daily consumption increased from three types of vegetables for non-trained farmers, to five for trained farmers. Nutrient intakes therefore also increased, showing that dissemination of these recipes is a valid strategy to address nutrient deficiencies in rural areas.

Opportunities for adoption

The recipes are highly nutritious and prepared from vegetables that are grown by many households. Adoption of these recipes would improve dietary diversity and increase micronutrient

intake. Similar approaches are likely to work in different regions.

The recipes could be used in school feeding programs. In addition to improving the nutrition and health of students, dissemination could provide opportunities to learn about food and nutrition, thereby developing knowledge of the importance of nutrition for growth and development, food safety, the cultural significance of foods, how to select and prepare food, healthy eating patterns, and how to meet nutritional needs on a limited budget through school and home gardens. Health centers, community clinics, and local restaurant owners are additional key target groups that can be made aware of the need for essential nutrition interventions through healthy recipes.

How to get started

Pumpkin soup

Ingredients

500 g pumpkin
2 carrots
2 tomatoes
2 potatoes
2 onions
2 l of water

Procedure

1. Wash and peel the vegetables, then chop finely.
2. Boil the vegetables with water and salt for about 15 minutes or until soft.
3. Stir well or blend the mixture.
4. Add black pepper, milk, spice mix, and margarine. Bring to a boil; stir well for five minutes.
5. Season to taste, serve while hot.



Pumpkin soup. (Photo courtesy of Inviolata Mosha, 2020.)

Continued

Continued.

Key nutritional benefits

- Use fresh vegetables if possible to ensure high nutrient levels.
- Carrots are a good source of vitamin A.
- Pumpkin is high in antioxidants and helps combat chronic diseases, provides vitamins A and C to boost immunity, and contains potassium, manganese, and iron.
- Onions are high in vitamin C, which benefits immunity, tissue repair, and iron absorption.

African eggplant with okra

Ingredients

2 big tomatoes
2 onions
2 carrots
250 g okra
8 tablespoons cooking oil
500 g African eggplant
2 cups water (480 ml)
2 eggs
Salt to taste

Procedure

1. Wash, peel, and chop the tomatoes finely.
2. Wash and chop the onions.
3. Wash, peel, and cut the carrots lengthwise.
4. Wash the okra and cut off the end tips.
5. Fry the onions lightly in oil. Add tomatoes and salt, stir until soft.
6. Add African eggplant, okra, and carrots. Stir well.
7. Add water, cover the pan, and simmer for 10–15 minutes until the vegetables are soft.
8. Whisk the eggs until frothy, then add to the vegetables while stirring slowly for five minutes.
9. Season to taste.
10. Serve hot.

Key nutritional benefits

- Okra is a good source of vitamin C, K, and fiber.
- African eggplant contains a range of nutrients including fiber, potassium, beta-carotene, ascorbic acid, iron, and calcium.
- Eggs are rich sources of selenium, vitamin B6, B12, D, and minerals such as zinc, iron, and copper.
- Nutritional benefits of tomatoes, onions, and carrots are as described for pumpkin soup.





Ingredients required (top) to prepare the African eggplant with okra curry (middle) and the African eggplant with okra stew (bottom). (Photos courtesy of Inviolata Mosha, 2020.)

Nightshade relish

Ingredients

- 1 handful nightshade leaves
- 1 onion
- 2 carrots
- 4 tablespoons cooking oil
- 1 cup water (240 ml)
- 1 cup milk (240 ml)
- 1 cup groundnut flour (240 ml)
- Salt to taste

Procedure

1. Sort the nightshade leaves, wash, and chop.
2. Wash and chop the onion.
3. Wash, peel, and grate the carrots.
4. Fry the onions and carrots in oil until soft.
5. Add the chopped nightshade leaves with water and salt. Stir well and simmer for 10 minutes.
6. Mix milk with groundnut flour. Add to the pan and stir for five minutes.
7. Season to taste.
8. Serve while hot as a relish.

Key nutritional benefits

- Nightshade leaves contribute calcium and vitamin C to the diet.
- Groundnuts are rich in a range of minerals such as magnesium, phosphorus, potassium, and zinc. Groundnut is also a good source of plant-based protein, fiber, and vitamins.
- Milk reduces the bitterness in nightshade leaves and provides protein and fat.



Nightshade relish. (Photo courtesy of Inviolata Mosha, 2020.)

Continued

Continued.

Jute mallow with groundnut

Ingredients

1 handful jute mallow leaves
1 onion
2 carrots
Half a cup of groundnuts (120 ml)
1 cup water (240 ml)
4 tablespoons cooking oil
1 cup milk (240 ml)
Salt to taste

Procedure

1. Wash the jute mallow leaves, chop finely.
2. Wash and chop the onion.
3. Wash, peel, and grate the carrots.
4. Roast the groundnuts. Grind finely.
5. Boil water, add salt and chopped jute mallow, and cover the pan for 10 minutes.
6. Fry the chopped onion and carrots in oil until onions are light in color.
7. Add boiled jute mallow leaves and stir well.
8. Mix milk with groundnut flour, add to the vegetables and stir well while simmering for five minutes.
9. Season to taste and serve while hot as a relish.

Key nutritional benefits

- Jute mallow is rich in beta-carotene.
- Other nutritional benefits are as described above.

Amaranth cake

Ingredients

1 cup grain amaranth seeds (to make 1 cup flour)
3 cups wheat flour
6 teaspoons baking powder
Half a cup margarine
1 cup sugar
10–12 eggs
1 teaspoon vanilla
1 cup milk (240 ml)

Procedure

1. Soak the amaranth seeds. Dry and grind into flour.
2. Mix amaranth flour with wheat flour and baking powder.
3. Rub the flour with margarine thoroughly.
4. Add sugar and mix well.
5. Add eggs one at a time, stirring well after each addition.
6. Add vanilla and stir well.
7. Grease an aluminum pan or baking tin, pour in the mixture. While preparing the cake mixture, prepare the cake-baking pot.



Jute mallow relish. (Photo courtesy of Inviolata Mosha, 2020.)



8. Take an aluminum pot and gently pour the sand/well-cleaned gravel stones into the pot.
9. Place an aluminum or metal plate on top of the sand or stones and heat up for five minutes. Once the pot has heated up for five minutes carefully open the hot pot and place your aluminum/metal cake pan on the hot rack. Don't place it directly on the bottom of sand or stones.
10. Now cover it and heat for 30 minutes.
11. Carefully open the lid and check if it is done by dipping a knife or spoon deep inside. If there is nothing sticking to the knife or spoon, then the cake is ready. Extend the time if necessary.
12. Test, cool, and serve.

Key nutritional benefits

- Grain amaranth is a good source of minerals including iron, zinc, magnesium, and phosphorus; and protein (13–15 g per 100 g). It contains all the essential amino acids and is a good source of dietary fiber, and an excellent source of vitamin E.

Blackjack with coconut milk

Ingredients

- 2 l of water
- 1 handful blackjack leaves
- 1 onion
- 2 tomatoes
- 4 tablespoons cooking oil
- 1 cup water (240 ml)
- 1 cup coconut milk (240 ml)
- Half a cup groundnut flour (120 ml)
- Salt to taste

Procedure

1. Wash blackjack leaves and chop finely.
2. Wash and chop the onion.
3. Wash, peel, and chop the tomatoes.
4. Fry the onions in oil, add tomatoes and salt, stir until soft.
5. Add chopped blackjack leaves and stir well.
6. Add water, cover the pan.
7. Mix coconut milk with groundnut flour, add to the vegetables.
8. Simmer for five minutes.
9. Serve while hot.

Key nutritional benefits

- Blackjack is rich in fiber and vitamin E, and is a good source of calcium.
- Coconut milk provides fat and minerals, and improves taste.

Recipes adapted from WorldVeg (2015) and reproduced with permission.



Amaranth cup cake (top) and grain cake cut sliced into small pieces (bottom). (Photos courtesy of Inviolata Mosha, 2020.)



Blackjack with coconut. (Photo courtesy of Inviolata Mosha, 2020.)

Farmers' comments on gender and household decision-making in horticulture

Horticulture is one of the fastest-growing subsectors of agriculture in Tanzania. Gender relations in vegetable-producing and vegetable-trading households need to be understood to make value chain development equitable. A study carried out in northern and central Tanzania collected data from surveys, focus group discussions, and semi-structured interviews to assess the perceptions of men and women traders and producers regarding their participation in, and gains from, traditional vegetable value chains. Farmers reported gender-balanced intra-household labor arrangements paired with less balanced income and expenditures, while traders expressed less balanced labor contributions but more balanced benefit sharing. Farmers agreed that limited household development was associated with imbalances in benefits, and lack of trust and cooperation between spouses.

"Homes that lack participation are the homes that we say are still based on patriarchy," commented one man vegetable farmer in a focus group discussion in Babati. "Even when you look at their level of development, they haven't reached far. Because if the mother cannot advise the father, he is likely to do whatever he thinks is right, even if it is not."

Extension officers working with trained community workers should apply household methodologies to improve cooperation within farming households; this will lead to more balanced benefit sharing, including the benefits of better nutrition. The "gender and youth balance tree" exercise presented in [Chapter 1](#) is a useful tool to encourage household members to reflect upon inequalities and establish more balanced relationships. These will lead to more sustainable decision-making over the long term.

See Fischer *et al.* (2020) for more information.

References

- Anitha, S., Munthali, W., Msere H.W., Swai, E., Muzanila, Y. *et al.* (2017) Occurrence of aflatoxins and its management in diverse cropping systems of central Tanzania. *Mycotoxin Research*, 33(4), 323–331.
- Anitha, S., Muzanila, Y., Tsusaka, T.W., Kachulu, L., Kumwenda, N. *et al.* (2019) Reducing child undernutrition through dietary diversification, reduced aflatoxin exposure, and improved hygiene practices: The immediate impacts in Central Tanzania. *Ecology of Food and Nutrition*, 59, 243–262.
- Coates, J., Swindale, A. and Bilinsky, P. (2007) *Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator guide* (version 3). United States Agency for International Development, Washington, DC, USA.
- Ferguson, E., Chege, P., Kimiywe, J., Wiesmann, D. and Hotz, C. (2015) Zinc, iron and calcium are major limiting nutrients in the complementary diets of rural Kenyan children. *Maternal and Child Nutrition*, 11(3), 6–20.
- Fischer, G., Patt, N., Ochieng, J. and Mvungi, H. (2020) Participation in and gains from traditional vegetable value chains: A gendered analysis of perceptions of labour, income and expenditure in producers' and traders' households. *European Journal of Development Research*, 32, 1080–1104.
- Government of Malawi (2018) National Multi-sector Nutrition Policy. Department of Nutrition, HIV and AIDS. Available at: https://extranet.who.int/nutrition/gina/sites/default/filesstore/MWI_2018_National-Multi-Sector-Nutrition-Policy.pdf (accessed 21 June 2021).
- Jape, V.W. (2017) Patterns and determinants of vegetable intake in Babati District, Tanzania. Msc Dissertation. University of Copenhagen, Denmark.
- MoHCDGEC, MoH, NBS, OCGS, and ICF (2016) *Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16*. Ministry of Health, Community Development, Gender, Elderly and Children; Ministry of Health; National Bureau of Statistics; Office of the Chief Government Statistician; and ICF. Available at: <https://www.dhsprogram.com/pubs/pdf/FR321/FR321.pdf> (accessed 21 June 2021).
- NSO and ICF (2017) Malawi Demographic and Health Survey 2015–16. National Statistical Office and ICF. Available at: www.nsomalawi.mw/images/stories/data_on_line/demography/mdhs2015_16/MDHS_2015-16_Final_Report.pdf (accessed 22 June 2021).

-
- United Republic of Tanzania (2016) National Multi-sectoral Nutrition Action Plan for the period July 2016–June 2021. Available at: [Tanzania-2016-NMNAP.pdf \(unicef.org\)](#) (accessed 21 June 2021).
- WHO (2003) *Diet, Nutrition and the Prevention of Chronic Diseases*. Report of a Joint FAO/WHO Expert Consultation. World Health Organization, Geneva, Switzerland.
- WorldVeg (2015). *African Traditional Vegetables: Recipes for health and good taste*. The World Vegetable Center, Eastern and Southern Africa, Arusha, Tanzania.