



Role of wild, neglected and underutilized foods in reducing the cost of a nutritionally adequate diet in the eastern region of Baringo District, Kenya
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Bioversity International, Save the Children UK and National Museums of Kenya

Summary

The role of wild, neglected and underutilized species in achieving a cost reduction of a nutritionally adequate diet in the dry and wet season was investigated in the eastern region of Baringo District in Kenya. Baringo District is situated in the arid and semi-arid ecological zones of Kenya and local populations in the study region mainly include (agro-)pastoralists relying on supplementing their diet with food collected from neighboring forests and fields.

Ethnobiological surveys identified 5 wild fruit and vegetable species based on nutrient content and local population's preferences from a total of 340 species of edible plants and animals inventoried in both the dry (February/March) and wet (July/August) season in 2012. The 5 wild plant species (*Solanum nigrum* L., *Balanites aegyptiacus* (L.) Delile, *Ximenia americana* L., *Berchemia discolor* (Klotzsch) Hemsl. and *Ziziphus mauritiana* Lam.) were included in Save the Children's Cost of Diet tool. This linear programming tool estimated the lowest cost diet that meets the energy requirements and recommended nutrient intakes for mothers and children aged 6 to 24 months, taking into account the price and availability of local foods during dry and wet seasons as well as constraints on the 'locally accepted' amount of each food that can be included in the diet. This is called a locally appropriate, cost-optimized, nutritious diet (LACON) diet. The program was run with and without the selected wild species.

The LACON diets without the 5 wild species could not meet the recommended nutrient intakes for several essential micronutrients. During the dry season, the hypothetical diet of an infant aged 6 to 8 months did not meet the recommended nutrient intakes for iron, zinc, vitamin B6 and calcium; and iron was limited for all age groups (women and children). The wet season was better for meeting recommended micronutrient intakes, but iron was limited for women and infants aged 6 to 11 months and zinc was limited for infants aged 6 to 11 months.

Adding the 5 selected wild foods to the LACON diet resulted in a reduction of the cost of the diet of up till 64% for children aged 12 to 24 months in the dry season, as well as meeting the recommended intakes for iron for women and children between 12 and 24 months in both seasons.



Summary (continued)

Including the five wild foods in the LACON diets of 6 to 11 month old infants still resulted in inadequate intakes of iron and zinc in both seasons and calcium and vitamin B6 during the dry season. More targeted interventions are thus needed to improve micronutrient intakes throughout the year for infants between 6 and-11 months.

The study illustrated an application of the Cost of Diet tool to screen available wild and underutilized foods for meeting energy requirements and recommended nutrient intakes at a minimal cost in different seasons. Repeating the study in different settings with high malnutrition rates and refining the Cost of Diet tool to take into account more detail on availability and food intakes is needed to provide evidence for the role of biodiversity in nutrition and health. In addition, pilot projects that aim to increase the availability of wild and underutilized foods for safe consumption should be developed and the impact of increased consumption on various livelihood and nutrition outcomes should be measured.

Abbreviations :

CoD: Cost of diet

LACON: Locally appropriate, cost-optimized, nutritious diet

NUS: Neglected and underutilized species (including wild) for definitions see IPGRI et al. (2002)

Acknowledgements:

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AD and CK were involved in Cost of Diet Analysis; JM carried out the ethnobiological survey; FM and JF developed the proposal; BC and CT were responsible for review, analysis and poster content development

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1. Background

The determinants of poor nutrition are often rooted in poverty and inequity. Meeting nutrient needs of families while keeping costs to a minimum, improving resilience and respecting cultural traditions remains a challenge. For many populations, local and traditional foods, including wild foods can play an important role. However, for most of these species little is known about their nutritional value, safety, use and consumption patterns and their subsequent impact on human health, under-nutrition, over-nutrition and non-communicable disease risk. Policy makers, food producers, processors and consumers need better information to guide decisions and influence behaviors.

Kenya has diverse agro-ecological zones which contribute to a wide diversity of indigenous neglected and underutilized species (NUS). Maundu (1999) documented about 400 indigenous fruit species in the country and Messina (1999) reported traditional leafy vegetables, cereals and legumes with excellent nutritive properties. This broad and excellent variety of NUS, coupled with high rates of malnutrition (KNBS & ICF Macro, 2010), makes Kenya the ideal location to study the role of local foods in reducing the cost of meeting nutritional adequacy. The eastern region of Baringo District in the Rift Valley Province of Kenya has been selected for the study (Figure 1). The Rift Valley Province has persistently high rates of stunting in under five year old children (36%; KNBS & ICF Macro, 2010).

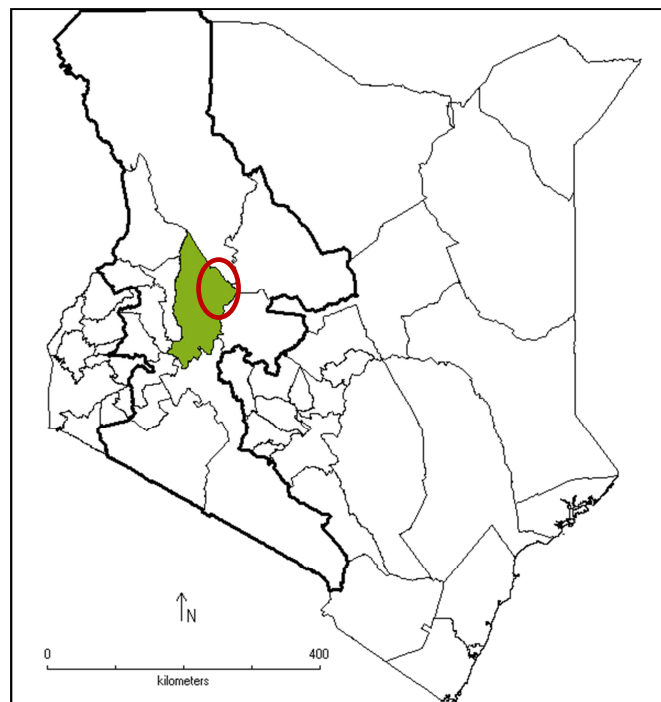


Figure 1: Map of Kenya, showing the study region, eastern region (red circle) of Baringo District (green) in Rift Valley Province (bold line). Source: made in DIVA-GIS by CT.

2. Methodology

- 1) Ethnobiological inventory of available wild and NUS in the area by means of focus group discussions in 10 villages and collection of voucher specimens deposited at the National Museums of Kenya during the dry (February/March) and wet season (July/August) in 2012.
- 2) Market survey to assess price and availability of all local foods by season.
- 3) Individual questionnaires and focus group discussions in 7 villages with mothers of different wealth groups to identify culturally acceptable average consumption frequencies of all foods; average food portion sizes were taken from a study carried out by Save the Children (unpublished data).
- 4) Selection of 5 wild NUS species for modeling in the CoD analysis under 5).
- 5) CoD analysis: information from 2) and 3) was entered into the CoD analysis software which uses linear programming to calculate a minimum cost **diet that meets the energy requirements and recommended nutrient intakes** for mothers and young children, taking into account constraints on the 'locally accepted' amount of each food that can be included in the diet. For the partially breastfed infants and young children, WHO recommended breast milk intakes were modeled in the diet. The program highlights which recommended nutrient intakes cannot be met using only locally available foods during each season. The modeled diet is hypothetical and does not necessarily reflect actual dietary intake of the studied population. Some foods used in the model are probably unaffordable for the (very) poor and actual nutrient gaps may therefore be larger than the nutrient gaps found in the modeled diets. The analysis was run with and without the selected wild NUS foods to assess their impact on the cost of a nutritionally adequate diet. For an overview of the underlying hypotheses and assumptions of the CoD analysis tool, see Save the Children's CoD practitioner's guide (2012).

3. Results and interpretation

- 1) Local food diversity found in the ethnobiological study:
 - a. A total of 87 edible food plants (29 fruits, 21 vegetables, 18 cereals, 19 roots and tubers), 10 edible mushrooms and 62 edible animal food species (39 mammals, 15 birds and 8 insects) were recorded during the dry season (February/March).
 - b. A total of 144 edible food plants (55 fruits, 47 vegetables, 23 cereals and pulses and 19 tubers), 10 edible mushrooms and 47 edible animal food species (26 mammals, 16 birds and 5 insects) were recorded during the wet season (July/August).
- 2) The foods chosen for modeling their effect on the cost of a nutritionally adequate diet were based on their availability and abundance in the two seasons, the availability and quality of their nutrient profile and the local population's preferences; they included: *Solanum nigrum* L., a wild vegetable and 4 wild fruits, *Balanites aegyptiacus* (L.) Delile, *Ximenia americana* L., *Berchemia discolor* (Klotzsch) Hemsl. and *Ziziphus mauritiana* Lam. (figure 2).
- 3) Table 1 shows the daily cost of the modeled diet for the different age groups per season without the 5 wild species and the percentage reduction in cost including each of the selected wild species apart in the model and for all selected wild species together. It was assumed that the wild foods could be eaten 3 to 4 times per week at zero cost. The

percentage of recommended nutrient intakes met by the modeled diet without wild species can be seen in figure 3 (only deficient nutrients are presented), as well as the additional contribution to meeting recommended nutrient intakes when all wild foods together or the wild fruit *B. Discolor* apart are included in the modeled diet.

The results from the CoD analysis indicate the following:

- a. The wet season is the lowest cost season of the two seasons studied, because more foods are available during the wet season harvest period.
- b. Although the modeled diet without wild species tried to meet the energy requirements and recommended/safe nutrient intakes for protein, vitamins A, B1, B2, B3, B6, B12, folic acid, calcium, magnesium, iron and zinc by design using locally available foods, the resulting diets are limited by several essential micronutrients, especially for infants aged 6 to 8 months (vitamin B6 and calcium deficient during dry season, iron and zinc deficient over the whole year). Diets are deficient in iron for all age groups (women and children) during the dry season.
- c. The 5 wild foods have the greatest impact on the daily cost of the diet when modeled together. There is potential to reduce the daily cost of a woman's diet by 120 to 175 KSh a day (or \$US 1.5 to 2.00 per day).
- d. The wild species *B. discolor* has the biggest impact on the cost of the diet when modeled on its own. By adding this fruit into the diet 3-4 times a week, the daily cost of the diet could potentially be reduced by 55% for women in both seasons and by 56% for children aged 12-24 months in the dry season. For infants under 12 months, the reduction in the cost of diet is negligible.
- e. *B. discolor* contributed to meeting recommended iron intakes by 100% for women and children aged 12-24 months. However, it was still not possible to meet recommended iron and zinc intakes for the partially breastfed 6-8 and 9-11 months old infants. The wild foods made little contributions to vitamin B6 and calcium requirements for the 6-8 months old. This may be due to the fact that portion sizes of the foods for these children are too small to make a significant contribution to nutrient intakes or the nutrient levels in the foods are too low to make a difference.



Figure 2: Five selected wild edible plant species for modeling in the Cost of Diet tool: from left to right: *Balanites aegyptiacus* (L.) Delile (Tulunyo, Tuyunwo); *Ximenia americana* L. (Kinyat, Kunyotwo); *Berchemia discolor* (Klotzsch) Hemsl.; *Ziziphus mauritiana* Lam. (Tulomwo/tilomwo) and *Solanum nigrum* L. Source: Amy Deptford (Save UK) and Missouri botanical gardens.

Table 1: Daily cost of a modeled nutritious diet without wild foods and percentage reduction of daily cost by integrating 5 wild foods in the model for the dry and wet season in Baringo District, Kenya

Age Group	Daily cost and percentage reduction of cost during the dry season (KSh)						
	Without wild foods added	<i>Balanites aegyptiacus</i>	<i>Ximenia americana</i>	<i>Berchemia discolor</i>	<i>Ziziphus mauritiana</i>	<i>Solanum nigrum</i>	All wild foods together
6-8 month old	20.6	-8.3	-1.9	0.0	-0.5	-0.5	-10.7
9-11 month old	36.0	-1.7	-4.2	1.9	1.9	0.3	-7.2
12-23 month-old	62.3	-9.6	-2.7	-56.2	-0.6	-11.4	-64.0
Women	226.9	-14.7	-3.9	-54.6	-0.9	-0.9	-63.6
Lactating women	263.0	-12.7	-4.0	-57.0	-0.8	-0.8	-63.4
Pregnant women	277.9	-12.8	-4.0	-56.8	-0.8	-9.0	-62.9

Age Group	Daily cost and percentage reduction of cost during the wet season (KSh)						
	Without wild foods added	<i>Balanites aegyptiacus</i>	<i>Ximenia americana</i>	<i>Berchemia discolor</i>	<i>Ziziphus mauritiana</i>	<i>Solanum nigrum</i>	All wild foods together
6-8 month old	16.2	1.9	0.0	0.0	0.0	0.0	5.6
9-11 month old	26.2	-5.3	-3.1	0.8	0.0	-0.4	-8.0
12-23 month-old	44.3	-17.4	-3.8	-49.9	-0.7	-16.0	-54.6
Women	200.8	-0.9	-0.3	-53.9	0.0	-0.1	-61.3
Lactating women	239.5	-4.3	-0.8	-57.5	-0.5	-0.6	-62.2
Pregnant women	252.7	-4.3	-1.1	-56.6	-0.1	-18.8	-61.2

Kenya Shillings KSh \$US1 = 85 Ksh

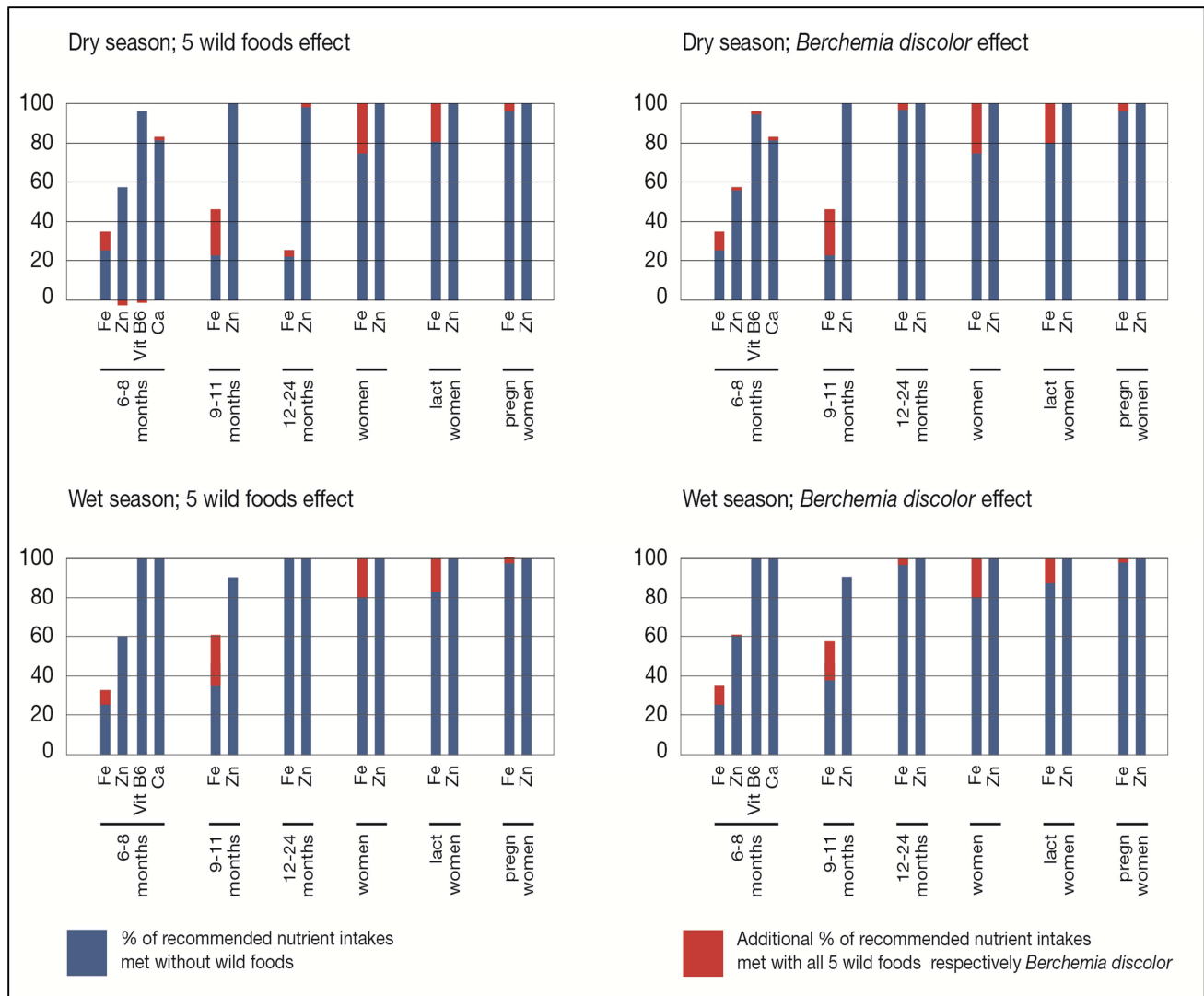


Figure 3: percentage of nutrient requirements met by the modeled diet without wild foods (only deficient nutrients are shown) and additional percentage of nutrient requirements met by including all 5 wild foods together or the wild fruit *Berchemia discolor* apart in the modeled diet for the dry and wet season in Baringo District, Kenya

4. Conclusions

- 1) The modeled diets based on local foods including wild foods, were not able to meet all recommended nutrient intakes for all age groups, but were considerably better in the wet season.
- 2) Adding wild foods, especially *B. discolor*, in the modeled diet resulted in a lower cost diet, while meeting recommended nutrient intakes for iron for women and children between 12 and 24 months.
- 3) Even after integrating wild foods in the model, targeted approaches are needed to meet micronutrient requirements throughout the year especially for infants between 6-8 and 9-11 months (iron, zinc, vitamin B6 and calcium).
- 4) Although income data were not collected, it is unlikely that poor households would be able to afford the modeled diet without the addition of wild foods. Therefore, there is great potential for nutritious wild foods, found at low cost, to make a positive impact on the cost and quality of the diet if these foods contain the nutrients and are safe and accessible.

5. Next steps

- 1) The model used in this study generated valuable results, however, there are a number of limitations and gaps to be addressed:
 - a. What is the actual dietary intake and how does this compare with the CoD tool LACON diets where portion sizes and consumption frequencies are based on focus group discussions, estimated amounts and other assumptions?
 - b. What is the practical feasibility of integrating wild foods in the diets in terms of amounts consumed, cultural acceptability, availability, affordability and safety?
 - c. For many wild NUS species nutrient information is often lacking or incomplete.
 - d. Scientific names are often lacking and further collection and identification of foods is necessary to complete the wild and underutilized food list for the region.
 - e. Investigating the availability and yield of wild and NUS species and assessing sustainable harvest levels is needed to verify if the proposed consumption levels of wild foods are 'sustainable'.
 - f. Further investigations to estimate the 'real' cost of wild food plants as well as on the potential for this foods to be included in nutrition sensitive value chains are also needed.
- 2) To increase our understanding of and provide the evidence for the multiple links between biodiversity, nutrition and health, the analysis should be conducted in a larger number of settings with high malnutrition rates. Subsequently, scalable projects to increase the availability of wild and NUS foods for safe production and consumption should be developed and the impact of increased consumption on various livelihood, diet and nutrition outcomes should be measured.

6. References

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