Methods

The cost of the diet

A diet is considered acceptable for an individual when it covers both the micro- and macronutrient requirements.[9]

The cost of the cheapest adequate diet was calculated using a linear programming tool and a spreadsheet model built in Microsoft Excel 2000. The original software was developed by WHO (http://www.nutrisurvey.de/lp/lp.htm) and was expanded by Save the Children so that it could estimate the cost of diets for all family members, not just young children. Linear programming is a classical mathematical tool used to solve problems such as, in this case, the estimation of the minimum cost of a diet subject to multiple nutritional and acceptability constraints. The model calculates the cheapest adequate diet using two standard databases and three sets of locally specific data. The food composition database built into the programme was established by the Food and Agriculture Organization (FAO), while individual nutrient requirements were based on WHO recommendations. Guided by these standards, the programme is able to determine the cheapest adequate diet when provided with:

- a list of locally available foodstuffs and prices per season;
- the household composition in terms of number and characteristics of household members for whom the diet is required;
- the maximum amount of each food that various household members can consume in order for amounts recommended by the programme to remain realistic.

The programme has the following assumptions built into the analysis:

• The energy provided by the diet must meet the total energy requirements of all the individuals. For instance, if there are 2 children in the 12-23 month age group, each with an energy requirement of 894 kcals, then the solver will look for a total diet providing 1788 kcals.

• The nutritional content provided by the diet (protein, fat, calcium, etc.) must not be less than the nutritional requirements across all the individual(s) covered. These are calculated from the quantity (in grams) of each food item in the diet, and the nutritional content provided by each gram. For example, if there are 2 children in the 9-11 month age group, each with a nutritional requirement of 54.0 mg of magnesium and 4.1 mg of zinc, then the solver will look for a total diet providing 108.0 mg of magnesium and 8.2 mg of zinc.

In this report, only the lowest cost physiologically acceptable diets are presented. It would probably be unreasonable to expect households to actually practice these diets for two key reasons:

a) There may be environmental constraints which prevent them from being feasible. For example, a family may be expected to collect 4 kg of wild green leaves per day in order to provide the cheapest possible source of nutrients. However, this may not be possible in practice if the source of food is not as abundant as required.
b) There may be cultural constraints which prevent them from being acceptable. Furthermore, diets which differ dramatically between parents and children may not be practical, as mothers may not be able to undertake separate food preparation processes because of fuel and time constraints.

[9] According to WHO standards.

Ensuring that the diets are both environmentally and culturally feasible requires an additional set of assumptions to be built into the data analysis, and also means an increase in the cost of the diet. While environmental and cultural diets were prepared for the four countries, they are not presented in this paper.

1. Seasonal food availability and price

The number of seasons in each location was determined from secondary sources (such as HEA reports) and discussion with key informants from the community and also local merchants (for information on prices).

For Bangladesh, the year was divided into four seasons: winter from mid-November to mid-March, summer from mid-March to mid-June, the rainy season from mid-June to mid-September, and the lean season from mid-September to mid-November. Data on food availability and prices were collected between September and December 2006 and referred to the period April 2005–March 2006.

For Ethiopia, the year was divided into four seasons: two rainy seasons pre-harvest when cereal prices are generally higher, and two post-harvest seasons when prices are correspondingly lower. The high cereal price seasons were taken to be August-October (season 2, pre-*Meher*) and January-May (season 4, pre-*Belg*), and the low cereal price seasons June-July (season 1, *Belg*) and November-December (season 3, *Meher*). Data on food availability and prices were collected during the period June 2006–February 2007 and referred to the period June 2005-May 2006.

For Myanmar, the year was divided into three seasons: winter from November to February, summer from March to May and the rainy season from June to October. Data on food availability and prices were collected during November-December 2006 and referred to the period November 2005-October 2006.

For Tanzania, the year was divided into two broad seasons:[10] the period prior to harvest during which prices are high, and the comparatively cheaper post-harvest period. The 'high price season' extends roughly over a five-month period from December to April, with the remainder of the year making up the 'low price season'. Data on food availability and prices were collected in March 2006 and July/August 2006. March prices represented the 'high price season' extending from December 2005 to April 2006, and July/August prices represented the 'low price season' from May to November 2006.

Training of data collectors

The first part of the training included reviewing nutrition concepts and theories (including the types and causes of malnutrition, feeding recommendations for children under the age of two, an overview of food security, etc.). This was followed by a review of secondary data to identify data collection needs. Trainees were actively involved in tailoring the data collection formats to the local context, to ensure familiarity with them. The data collection techniques (a combination of questionnaire and participatory interviews) were then discussed and standardised amongst team members. A strong emphasis was placed on ensuring quality data through cross-checking and various forms of triangulation. Data was consolidated periodically throughout the collection process to ensure that information gaps and inconsistencies were identified and filled.

[10] The year could have been further sub-divided into four seasons i.e. two main seasons and two transition periods.

2. Household composition

All the data presented in this report relate to a 5-person household consisting of:

- A child (of either sex) aged 12-23 months
- A child (of either sex) aged 3-4 years
- A child (of either sex) aged 7-8 years
- A man aged 30-59 years, weighing 50 kg and vigorously active
- A woman aged 30-59 years, breastfeeding, weighing 45 kg and vigorously active

The decision on the household composition was arbitrary, but deliberately included a child under 24 months of age to comply with the overall purpose of the research.

The decision to use a household size of 5 members was based on the typical size of households across different wealth groups in the study area (see Table 1).

Table 1: Household sizes in study areas

	Source of data	Household size
Bangladesh	Exhaustive household economic survey in one village[11]	Average across all wealth groups was 4.7
Ethiopia	Updated Household Economy Approach (HEA) Baseline for South Wollo Highland Belg Zone[12]	Varied from 3-8 members in different wealth groups; the only common size in all wealth groups was 5
Myanmar	Household Economy Approach Baseline in Kangyidaunt Township[13]	Average across all wealth groups was 5-6
Tanzania	Household Economy Approach Baseline 2003,[14] Study of the poorest households 2006,[15] Dietary survey[16]	Average across all wealth groups according to the census conducted for the study of the poorest households was 4; the 2003 HEA presented a typical size of 6.

3. Maximum amount thresholds

Maximum amounts of each food and food types for different age groups were determined as a maximum percentage of the daily energy requirement (shown in Table 2). For example, the energy contribution made by leafy vegetables cannot exceed 5% of the nutritional requirement. The thresholds were agreed through consultation with experts at University College London, WHO and the University of California, Davis, but have not been internationally agreed; it is also not yet clear whether these thresholds should be standardised across countries.

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[11] Seaman, J. et al (2005), 'A Study of the Relationship between Household Economy and Nutritional Status in a Village in Kurigram, Bangladesh', Save the Children UK, unpublished report.

[12] Save the Children (2006), *Amhara Regional State, South Wollo Highland Belg Zone Livelihood Profile*, Save the Children UK.

[13] Save the Children (2007), *Household Economy Assessment of Kangyidaunt Township, Ayeyarwaddy Division, Myanmar*, Save the Children UK.

[14] Save the Children (2003), *Livelihoods of Lindi Rural District: A Household Economy Assessment in Southern Tanzania*, Save the Children UK.

[15] Save the Children (2007), *Tackling Extreme Poverty: The Role of Cash Transfers and Complementary Social Protection Measures*, Save the Children Tanzania.

[16] Save the Children (2007), *Tackling Chronic Malnutrition: What Would it Take to be Able to Afford a Quality Diet? An Example from Lindi Rural District*, Tanzania, Save the Children UK.

Table 2: List of maximum percentages of energy requirement

Staples	100
Dairy	100
Fats	30
Fish	20
Fruit	8
Leafy vegetable	5
Pulses	50
Meat	20
Eggs	20

The amount of breastmilk for a child of 12-23 months used was 549 ml, based on average intakes of breastmilk.[17]

The affordability of the diet

The affordability of the diet was judged using a variety of related methods depending on the data available in each study area.

In Bangladesh, income data were gathered through an economic survey which included all households in the selected village. This was conducted in January 2005, with the data referring to the period January–December 2004. The survey design was based on the analytical framework adopted by Household Economy Approach[18] and is described in detail in Seaman et al (2005).[19] The 2004 income distribution was adjusted to 2006 prices using published inflation rates, specific to food prices, from the Central Bank of Bangladesh. These figures were 7.90% for 2004-5 and 7.76% for 2005-6. The cash equivalent of the food produced was determined by multiplying the amounts produced (as presented in the HEA/IHEA/IHM databases) by 2006 food prices.

In Ethiopia, a household economy assessment was carried out in 2006 with the data gathered relating to the year July 2004-June 2005. Comparison with price data collected for this study (i.e. the period June 2005-May 2006) indicated that there had been no inflation in the food prices, so no adjustment was necessary. The cash equivalent of the food produced and consumed was determined by multiplying the amounts by 2005-6 food prices.

In Myanmar, a household economy assessment was conducted in Kangyidaunt Township as part of a training exercise in 2006. This referred to the period April 2003-March 2004. These data were adjusted for inflation at 35% per year (a figure provided by Save the Children's micro-credit programme) and food income was converted into a cash equivalent at 2005-6 prices.

In Tanzania, a household economy analysis relating to the year March 2002-February 2003 described typical 'better-off', 'middle' and 'poor' households. In 2006, a more in-depth HEA study (referring to the period April 2004-March 2005) was

[17] WHO (1998), *Complementary Feeding of Young Children: A Review of Current Scientific Knowledge*, WHO, Geneva. Available at: http://www.who.int/child-adolescent-health/publications/NUTRITION/WHO_NUT_98.1.htm - see Chapter 3, Table 7, p. 47.
[18] Seaman, J. et al (2002), *The Household Economy Approach: A Resource Manual for Practitioners*, Save the Children UK, London.
[19] Seaman, J. et al (2005) - see footnote 11.

conducted which refined the 2003 results and provided a detailed picture of common household profiles within the 'very poor' and 'extremely poor' categories. The cash equivalent of the food produced and consumed was determined by multiplying the amounts by 2005-6 food prices. The inflation measures used to adjust the total income estimates for the poor, middle and better-off households are shown in Table 3.

Table 3: Inflation rates[20] used to adjust income estimates in Tanzania

2006	6.20%
2005	4.50%
2004	4.10%
2003	4.40%

Household size
Where the typical household size in a particular wealth group was not 5, household cash and food income was adjusted as necessary to a household size of 5.

Error ranges
5% error ranges were calculated for the HEA estimates of food and cash income for Tanzania and Ethiopia. A 10% error range was used for Myanmar as the team which conducted the HEA assessment included some trainees. Ranges were not estimated for Bangladesh because individual households were observed.

Exchange rates
Prices were converted into British pounds and US dollars using historical exchange rates for the mid-point of each season over the time period to which the data relate. For example, for Bangladesh the price data were collected for the period April 2005-March 2006. The exchange rate for January 15 2006, the mid-point of the winter season which runs from mid-November to mid-March, was multiplied by 4 (months), added to the mid point for each other season multiplied by the duration of the season, and the total was divided by 12 months to provide the average annual exchange rate. Historical exchange rates were obtained from http://www.oanda.com/.

For Myanmar, where official exchange rates vary considerably from the reality and an exchange rate of 1140 kyat to 1 USD was used.

[20] Official government statistics.

Methodological limitations

Cost of the diet estimation

1. The database has a limited number of food items (1717), so it was not always possible to find the exact food from the study areas. In these circumstances, the same food from the closest country on the database was chosen.

2. Some wild foods are not available on the database, so for these the closest item on the system was chosen (e.g. sour orange was chosen to represent tringos in Ethiopia).

3. An arbitrary decision had to be made on the household demographic profile to use in the analysis, as in reality every household will have a slightly different composition.

4. The maximum percentages of the energy requirements (Table 2) are based on the advice of experts. Adjustments to these could have an impact on the cost of the diet.

   In order to estimate the potential impact of these limitations on the results, we re-ran the data analysis for the low price season in Tanzania with the following adjustments:
   a) we chose a different country source for the food (rather than the closest country to the study country) - diet 2
   b) we used a household profile with members of the same age, but where adult members instead had medium physical activity levels - diet 3
   c) we used a household profile with older children – aged 12-24 months, 12-13 years and 16-17 years – diet 4
   d) we used a household profile with younger children – aged 12-24 months, 2-3 years and 3-4 years - diet 5
   e) we used a combination of b) and d) above as this was likely to result in the cheapest diet – diet 6
   f) we adjusted the maximum amount of kcals which could be obtained from leafy vegetables to 10% (from 5%) – diet 7

These adjustments resulted in the costs for the family diet during the low price season in Tanzania shown in Table 4.

Using data from Table 4, the highest value (876 Tsh) is 124% of the value for Diet 1 (708 Tsh), and the lowest value (628 Tsh) is 88% of the value for Diet 1. For this reason, ranges 25% above and 15% below the value found are presented in this report.

Table 4: Costs for the family diet, Tanzania low price season

	Country source of food	Adult physical activity levels	Age of children	Maximum amount of kcals from different food groups	Daily cost of family diet (Tsh)
Diet 1	Country closest to study country	High	12-23 months, 3-4 years, 7-8 years	As in Table 2	707.5
Diet 2	The first country on the list which was not closest to the study country	High	12-23 months, 3-4 years, 7-8 years	As in Table 2	659.6
Diet 3	Country closest to study country	Medium	12-23 months, 3-4 years, 7-8 years	As in Table 2	717.8
Diet 4	Country closest to study country	High	12-24 months, 12-13 years, 16-17 years	As in Table 2	875.8
Diet 5	Country closest to study country	High	12-24 months, 2-3 years, 3-4 years	As in Table 2	645.6
Diet 6	Country closest to study country	Medium	12-24 months, 2-3 years, 3-4 years	As in Table 2	628.1
Diet 7	Country closest to study country	High	12-23 months, 3-4 years, 7-8 years	As in Table 2 but increased to 10% for leafy vegetables	677.4

Affordability estimations

5. Several related but different methods were used to collect the income data. In Bangladesh, data were collected for individual households across the wealth spectrum. In Ethiopia and Myanmar, the Household Economy Approach (HEA) was used to collect data for typical households representing the primary wealth groups. This approach, which is standardised and widely used, estimates income in the form of food (crops, livestock products, wild foods, payments-in-kind, etc.) and as cash (crop and other production sales, employment, etc.) for typical households representing locally defined wealth groups (e.g. 'poor', 'middle' and 'better-off'). In Tanzania, income data for 'poor', 'middle' and 'better-off' groups came from using HEA, while that for 'extremely poor' and 'very poor' profiles came from individual household interviews.

   HEA wealth groups are defined by household assets (including labour). Under conditions where assets can be exploited effectively, this would be expected to be a good proxy for direct income estimates. To date, this assumption has only been tested formally in one location[21] and informally in Salima District, Malawi. In both cases, the HEA and direct income estimates were reasonably consistent.

[21] Seaman, J. et al (2006), *Extending the HEA to Support the Design of Cash Transfer Projects in Zambia*, Regional Hunger and Vulnerability Project (RHVP), Johannesburg.

6. The proportion of a population that cannot afford a given diet cannot be calculated precisely from the HEA figures for the percentage of a population in a particular wealth group. If, for example, 50% of a population are in the 'poor' group with an average total income of 200, and the cost of an adequate diet is 300, then it does not necessarily mean that 50% of the population cannot afford the diet. The 200 represents the average income of the group, and the variability of income within it (e.g. 150-250) has to be taken into account. However, we can state that "a poor family with an average income would not be able to afford the recommended diet".

7. As described above, the income data for comparison with the cost data is required for the same year. To avoid costly data collection exercises, we made inflation adjustments to existing datasets. However, using inflation as a proxy for changes in income may be very imprecise. Inflation is a measure based on changes in the purchasing price of a basket of commonly bought goods and services. For it to be an accurate proxy of changes in income, the following conditions need to be met:
   (a) price changes in the markets used to measure inflation are similar to those for markets in the study area;
   (b) prices for the goods and services that people sell to earn income keep close pace with the prices for goods and services that they buy, and
   (c) the amounts of goods and services that people sell have not changed in the period since the baseline data was collected.

   Situations in which these conditions may not be met include, for example:
   (a) if the study area is any more or less remote, or its markets are more or less competitive and integrated compared to where the inflation rate was measured, the local level of inflation may actually be quite different;
   (b) incomes in rural developing countries are generally not index-linked to inflation, and the price of labour, crops and livestock etc. may be influenced by forces other than the overall inflation rate;
   (c) depending on the type of year and various other factors, the amount of goods and services that people sell may have changed quite a bit from the baseline year, irrespective of changes in the price.

8. All households need some non-food goods e.g. minimal clothing, matches, etc. and will if necessary forego food to obtain these. The affordability of a diet therefore depends on an assumed package of non-food goods. Realistically, the best way to do this is to simulate a basket (soap, clothing, fuel, school fees, etc.) which represents a basic acceptable standard of living (this requires a reasonable list of locally-relevant goods and current price data for them). An estimate of the affordability of a diet which does not make allowance for non-food needs is not very meaningful.

Due to these limitations, the following steps have been taken:

a) The results are presented as estimates with ranges (to address limitations 1, 4 and 6)
b) It is clearly shown in the discussion that non-food needs are not included and that this has an impact on the affordability of the diet.
c) Error ranges were calculated for the annual HEA estimates of food and cash income.