

Annex 1: Good sources of important nutrients

Young children, like everyone else, need many different nutrients for growth and development, to provide energy, and to keep healthy. We have shown that most young children have sufficient protein in their diets. The main problem nutrients are *iron*, *zinc* and *vitamin A*. Also important is *vitamin C* which helps iron absorption, and *calcium* for building bones and teeth. The following foods are good sources of these nutrients.

Iron: Good sources were listed in Box 1 on page 19.

Zinc:

- liver and offal of all kinds
- foods prepared with blood
- flesh of animals, birds and fish
- shellfish
- egg yolk.

Vitamin A:

- breast milk
- liver of all kinds
- red palm oil (unbleached)
- egg yolk
- orange-coloured fruits – mango, paw-paw, passion fruit (but not oranges). The darker the colour the more vitamin A
- orange-coloured vegetables – carrot, pumpkin, yellow sweet potato, red/orange peppers (but not tomatoes). The darker the colour the more vitamin A
- dark-green leaves – spinach, amaranthus, kale, cassava leaves, sweet potato leaves, pumpkin leaves, broccoli. The darker the green the more vitamin A.

Vitamin C: (cooking destroys some vitamin C)

- fresh fruit – guava, orange, lemon, mandarin, mango, paw-paw, berries, melon, banana, passion fruit, peach
- tomato, peppers
- green leaves and vegetables – spinach, amaranthus, kale, cassava leaves, sweet potato leaves, cabbage, broccoli, cauliflower
- baobab pulp
- fresh starchy roots and fruits are good sources if large amounts are eaten – potato, sweet potato, cassava, plantain.

Calcium:

- milk and milk products – cheese, yoghurt
- fish eaten with bones – small whole fish, pounded dried fish, canned fish.

Annex 2: Recipes for good mixed meals from four countries (Figure 9, p 32)

(Each meal fills at least one-third of the gaps for energy, protein, iron and vitamin A)

Example from East Africa (maize + groundnuts + egg + spinach meal)

Thick maize porridge	4½ tablespoons	(140g)
Groundnut paste	1 tablespoon, rounded	(15g)
Egg	one	(30g)
Spinach	handful of leaves	(20g)

Make a thick porridge with maize flour. Pound groundnuts and add to the porridge. Just before serving add the raw egg and cook for a few minutes. Fry onions and tomato for flavour, add spinach. Serve separately or mix with porridge.

Example from India (chapati + dhal + carrot/amaranthus meal)

Chapati	half	(50g)
Dhal (cooked)	1 tablespoon, rounded	(30g)
Carrot	half a small one	(25g)
Amaranthus	handful of leaves	(30g)
Ghee	1 teaspoon	(5g)
Milk	½ cup	(50g)

Cook dhal (lentils) until soft with spices (for flavour). Add carrot and ghee when dhal are nearly ready. Serve with chapati and steamed amaranthus. (Alternatively add the leaves to the dhal/carrot mixture when these are cooked).

Example from Peru, South America (rice + beans + liver)

Rice	3 tablespoons	(84g)
Bean and potato stew	1 tablespoon	(30g)
Liver	½ tablespoon, rounded	(15g)
Margarine	1 teaspoon	(5g)

Boil the beans with onions and spices for flavour until nearly soft. Add potato and continue cooking. (Alternatively add cooked potato). Cook a chicken's liver (e.g. in the stew or steamed with the rice). Mash the potato, beans and liver with well-cooked rice and a little margarine.

Example from Syria, Middle East (rice + lentils + yoghurt)

Cooked rice	3 tablespoons, rounded	(84g)
Lentils	1½ tablespoons, rounded	(30g)
Oil	1 teaspoon	(5g)
Yoghurt	3 tablespoons	(50g)
Orange	half a small one	(50g)

Fry onions (for flavour) until brown and add spices. Boil lentils until soft. Cook rice and add the rice and lentils + liquid to the onions. Simmer gently. Serve with yoghurt.

Annex 3: Composition (per 100g) of some foods

Food	Description	Energy (kcal)	Protein (g)	Iron (mg)	Vitamin A (µg RE)
Maize flour	White, refined	335	8	1.1	0
Wheat flour	White, fortified	341	9.4	2.0	0
Bread	White, fortified	235	8.4	1.6	0
Rice	Cooked	138	2.6	0.2	0
Potato	Cooked	75	1.5	0.3	0
Sweet potato yellow	Cooked	84	1.1	0.7	660
Cassava	Raw	153	0.7	1.0	0
Chapati	No fat	202	7.3	2.1	0
Kidney beans	Boiled	100	6.9	2.0	0
Mung beans	Raw, dried	279	23.9	6.0	0
Mung beans	Boiled	91	7.6	1.4	0
Soy beans	Raw, dried	370	35.9	9.7	0
Groundnuts	Raw	564	25.6	2.5	0
Sunflower seeds	Raw	581	19.8	6.4	0
Melon seed	Raw	595	26	7.4	0
Chicken liver	Raw	135	19.1	9.5	11325
Beef, lean	Raw	123	20.3	2.1	0
Lamb, lean	Raw	162	20.8	1.6	0
Pork, lean	Raw	147	20.7	0.9	0
Chicken (light meat)	Raw	116	21.8	0.5	0
Chicken (dark meat)	Raw	126	19.1	1.6	0
Fish	Raw	76	17.4	0.3	0
Fish	Steamed	98	22.8	0.2	0
Fish small	Dry whole	320	44	8.5	na
Milk	Fresh, whole	66	3.2	0.06	55
Cheddar cheese		412	25.5	0.3	362
Egg	Boiled	147	12.5	1.9	190
Carrot	Raw	35	0.6	0.3	1350
Carrot	Boiled	24	0.6	0.4	1260
Spinach	Boiled	19	2.2	1.6	640
Pumpkin	Boiled	13	0.6	0.4	160
Tomato	Raw	17	0.7	0.5	107
Mango		57	0.7	0.7	300
Orange		37	1.1	0.1	5
Paw-paw		36	0.5	0.5	135
Banana		95	1.2	0.3	3
Avocado		190	1.9	0.4	2
Sugar		394	0	0	0
Red palm oil	Unbleached	890	0	0	4000
Ghee		898	0	0	758
Margarine		739	0.2	0.3	780

Annex 4: Technical Data

In Figs 1 and 2, the energy and iron needs of an *average* child have been taken as:

	Energy (kcal/d)	Absorbed iron (mg/d)
0–2m	404	1.14
3–5m	550	0.90
6–8m	682	0.78
9–11m	830	0.66
12–23m	1092	0.49

(References WHO 1998 Table 9, FAO/WHO 1988, adapted from Table 5.1)

In Figs 1 and 2, we have taken the energy and iron intakes from breast milk as:

	Breast milk (g/d)	Energy (kcal/d)	Absorbed iron (mg/d)
0–2m	714	493	0.043
3–5m	784	540	0.047
6–8m	674	465	0.040
9–11m	616	425	0.037
12–23m	549	379	0.033

In Figs 1–8, in calculating energy, protein, iron and vitamin A intakes from breast milk, we have used WHO 1998 Tables 7 and 22 and an energy content of 69 kcal /100ml. We have assumed that the absorption of iron from breast milk is 20%.

In Figs 3–8, the energy, protein, iron and vitamin A needs of an average child aged 12–23m have been taken as:

Energy (kcal)	Protein (g)	Absorbed iron (mg)	Vitamin A (µgRE)
1092	10.2	0.49	300

(References WHO 1998, Dewey et al 1996, FAO/WHO 1988, Department of Health 1991). For protein, we assumed a digestibility of 85% and that the amino acid needs are met.

Portion sizes of cooked foods in Figures 3–8

1 rounded tablespoon rice	28g (3 tablespoons 84g)
1 teaspoon fat	5g
1 rounded tablespoon beans	30g
1 rounded tablespoon fish	30g
1 rounded tablespoon liver	30g
1 rounded tablespoon green leaves	27g
1/2 small orange	50g
1 slice bread + margarine	20g + 5g
1 small banana	60g

We took 6µg carotene as equivalent to 1µg retinol.

We allowed for the enhancing effect of fish/meat and vitamin C on iron absorption from plant foods.

For this we assumed the absorption of iron to be:

iron in rice/porridge	5%
iron in rice/beans	5%
iron in rice/beans when eaten with fruit	10%
iron in rice when eaten with fish/liver	10%
iron in rice when eaten with fish/liver + leaves	15%

The energy and nutrient contents of the portions indicated in Figs 3–8 are thus:

	Amt. (g)	Energy (kcal)	Protein (g)	Absorbed iron (mg)	Vitamin A (µg)
staple	84	116	2.2	0.17 x 5% = 0.008 x 10% = 0.016* x 15% = 0.024**	–
fat	5	45	–	–	–
beans	30	30	2.1	0.60 x 5% = 0.030 x 10% = 0.060*	–
fish	30	29	6.8	0.21 x 15% = 0.031	–
liver	30	40	5.7	2.85 x 15% = 0.427	3397
leaves	27	5	0.6	0.43 x 15% = 0.064**	173
orange	50	19	0.5	0.05 x 10% = 0.005	3
banana	60	57	0.7	0.18 x 5% = 0.009	2
bread	20	47	1.7	0.30 x 5% = 0.015	–
porridge + milk/sugar	100	144	3.6	0.12 x 5% = 0.006	–
breast milk	549	379	5.8	0.16x20% = 0.033	274

*Vitamin C at the same meal enhanced iron absorption to 10%

** Fish/liver + vitamin C at the same meal enhanced iron absorption to 15%

References

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