

# NUTRIENTS: FUNCTIONS, SOURCES & REQUIREMENTS

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- This Factsheet is about the nutrients in food. Eating a healthy balanced diet, including all of the food groups, as outlined in Factsheets 1.1 and 1.2, will provide all the nutrients and energy toddlers need (apart from vitamin D – see Factsheet 1.1).
- Most toddlers have body stores of all these nutrients and poor eating for a day or two will not deplete them of any. Over a week or so toddlers' nutritional intakes will usually average out and cover their full needs.
- This Factsheet is not a guide to what toddlers should eat – that is covered in Factsheets 1.1 and 1.2 – but summarises in what foods nutrients can be found, what they do, how much of them is needed and the signs of nutrient deficiencies or excess. The nutrient requirements of toddlers are expressed as a reference nutrient intake (RNI), a term that is explained on page 2.

# DIETARY REFERENCE VALUES FOR NUTRIENTS

The terms below appear on the labels on foods and drinks, and on vitamin and mineral supplements. They are also used by public health bodies, government and other agencies, to define nutritional requirements. Collectively they are called 'dietary reference values' (DRV).

**RNI** 'Reference Nutrient Intake' is the amount recommended per day for any age group to make sure they all get enough.

**EAR** 'Estimated Average Requirement' is the average needed for a defined age group.

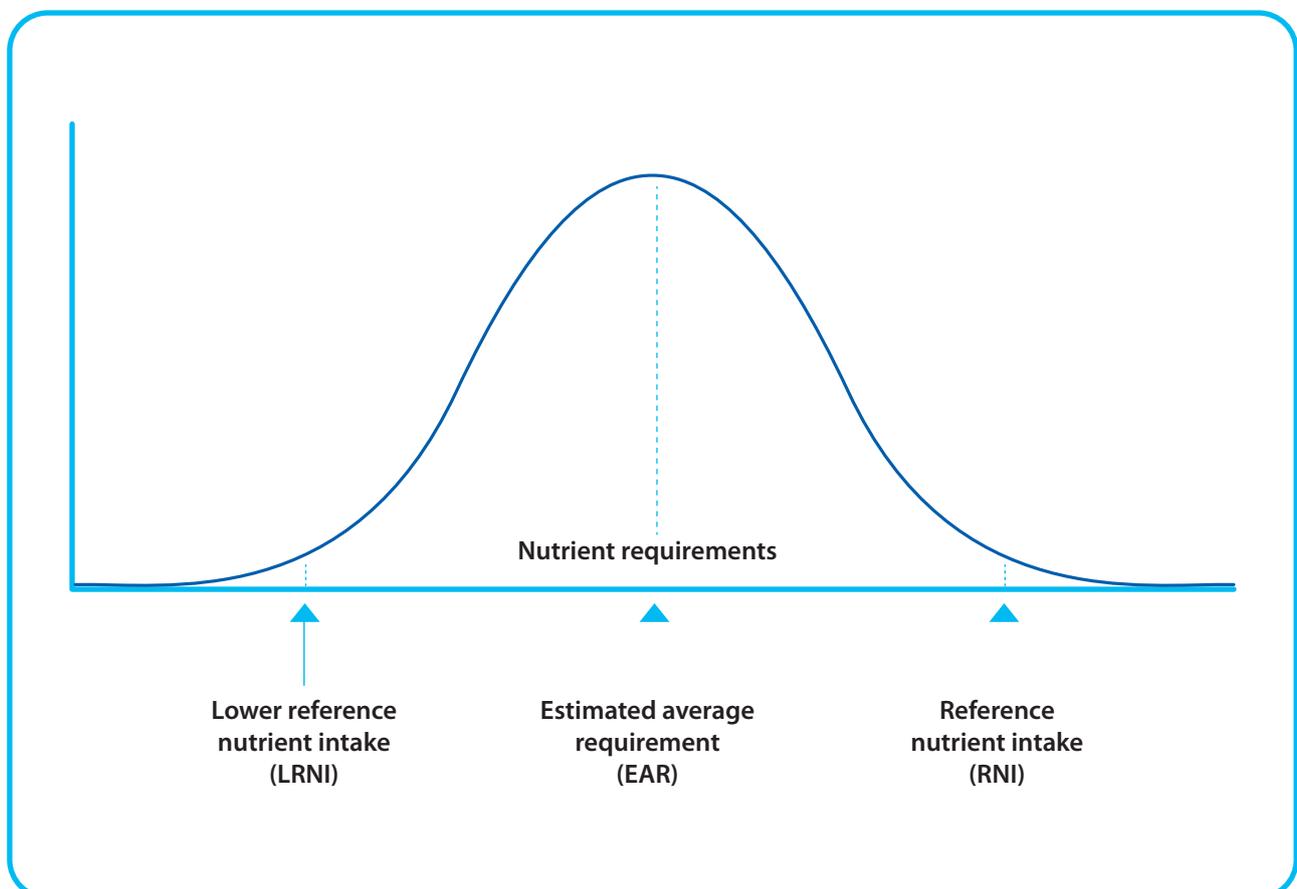
**LRNI** 'Lower Reference Nutrient Intake' is the amount below which most people in a defined age group will be deficient.

**SI** 'Safe Intake' A recommended amount per day where there is not enough evidence to define an RNI

**RDA** 'Recommended Daily Amount' is used for the whole population but **should not be used for toddlers and young children as it applies to adults.**

The relationship between these terms is shown in the bell-shaped curve below, which describes the normal range of nutrient requirements of a population of a defined age group. DRVs vary according to the age of people and sometimes to their body weights. In toddlers estimates of some RNIs are based on limited data. DRVs change over the years and should be regarded as best estimates at the time that they were set. They are often reviewed in the light of new information.

RNIs have been set 'high' on the curve in order to ensure that they supply the needs of the vast majority. With the exception of energy (excess energy intake leads to obesity) consumption of a nutrient above its RNI is not harmful, unless in great excess.



Nutrient	Function in the body <sup>1</sup>	Food sources which toddlers enjoy <sup>2</sup>	Daily requirement (RNI) for 1-3 year olds <sup>2</sup>	Signs of deficiency or excess in toddlers <sup>3</sup>
<p><b>Protein</b> Made up of, and is a source of, peptides and amino-acids.</p>	<p>Provides structure for all cells in the body, enzymes and carrier molecules. Growth increases requirement as extra protein is needed for new muscles and other cells.</p>	<p>Richest sources are milk, yogurt, cheese, meat, fish, eggs, ground and crushed nuts and nut butters – Good sources are pulses such as dhal, lentils, baked beans, hummus and other starchy beans: chick peas, butter beans and red kidney beans. Cereals and foods containing flour such as bread, chapatti and pasta also provide some protein.</p>	<p>14.5g/day.</p>	<p>Deficiency of protein alone is rarely seen in the UK. Poor growth and development would result. Muscle wasting is a sign of severe protein deficiency although it can have other causes.</p>
<p><b>Carbohydrate</b> May be 'simple' sugars, such as sucrose and glucose, or 'complex' such as starches and digestible fibre. Fructose is the sugar in fruit and honey. Lactose is the sugar in milk.</p>	<p>Provides energy (calories).</p>	<p>Potatoes, yam, breakfast cereals, couscous, rice and any foods containing flour such as bread, chapatti, pasta, pastry, biscuits and cake. Fruit, honey and milk. Milk puddings such as sago, and tapioca as well as rice. Foods containing refined sugar such as sweet drinks and foods e.g. puddings and sweets.</p>	<p>No RNI. About 50% of energy should be taken as a carbohydrate' should be on a separate line like this: Requirements depend on activity and how much fat is eaten. About 50% of energy should be taken as carbohydrate. 5% or less of energy should come from free sugars which excludes lactose and the fructose in whole fruit.<sup>4</sup></p>	<p>Insufficient energy (calories) from carbohydrate (and fat) causes poor growth and development. Faltering growth due to low calorie intake is not uncommon in the UK. Excess carbohydrate intake can cause obesity. Excess and frequent intake of simple sugars can cause dental caries. In England 25% of 5 year old children already have some dental decay.<sup>5</sup></p>
<p><b>Fat</b> Sometimes called 'lipid', and is made up of – 1. Fatty acids which may be short, medium or long chains of: • saturated • mono unsaturated • polyunsaturated including omega 3 &amp; omega 6. 2. Complex fats e.g. cholesterol and phospholipids.</p>	<p>Provides energy. The membranes of all cells are made of lipids, including those of the nervous system. The omega 3 and 6 fats are essential for brain and nerve function and healthy skin. Transport of fat soluble vitamins.</p>	<p>Oils and fats used to fry foods. Butter, margarine and other spreads for bread. Cream and cheese. Cakes, biscuits and crisps. Small amounts in whole milk and yogurt, egg yolks and lean meat. There are usually plenty of omega 6 fats in the diet. Oily fish in fish pie or fish cakes are good sources of omega 3 long chain fats, DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid).</p>	<p>No RNI. About 35% of energy should be taken as fat. Omega 3 and omega 6 fats are essential – the body cannot make them, and they must be part of the diet. 0.2% or more of total energy should come from omega 3 fats. 1% or more of total dietary energy should come from omega 6 fats.</p>	<p>Insufficient energy (calories) from fat (and carbohydrate) causes poor growth and development. Excess fat intake can cause obesity.</p>

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<b>Fat (continued)</b>		Rapeseed oil and walnut oil are good sources of omega 3 ALA (alpha- linolenic acid). Olive and soya oils have a good balance of omega 3 and omega 6.		
<b>Fibre</b>	Regular functioning of intestines and bowel. Feeds the bacteria in the colon and maintains colonic health.	Fruits and vegetables, cereals and foods made from flours. Wholegrain cereals such as porridge, Ready Brek and Weetabix contain more fibre than most processed cereals. Wholegrain flours and breads will contain more fibre than white flour and breads.	15g/day for 2 – 5 years <sup>4</sup> No defined recommendation for those under 24 months of age.	Constipation and disordered bowel habit may be exacerbated with too little fibre intake.
<b>Fluid</b>	For maintaining normal hydration, blood pressure and fluid balance. Toddlers' bodies are about 70% water.	Water. Milk, fruit juices and diluted squashes are all about 90% water. Soups, sauces, fruit and vegetables have high water contents.	Six to eight drinks per day in addition to fluid in some foods. About 120mls (4oz) is an average drink for one to three year olds. More may be needed on a very hot day and after a lot of physical activity.	Constipation may be exacerbated by, or can be a result of, too little fluid intake. Dehydration caused by not enough fluid, can cause lethargy.
<b>Vitamins</b>				
<b>Vitamin A (Retinol and <math>\beta</math>-Carotene)</b>	Ensures normal growth and development, strengthens immune system, healthy skin and good night vision.	Whole cows' milk. Orange, red and dark green fruit and vegetables such as carrots, red peppers, tomatoes, sweet potato, pumpkin, apricots, mangoes, cantaloupe melons, broccoli. Fish pie or fish cakes using oily fish. Liver pâté.	400ug/day.	Deficiency causes night blindness, skin problems, and increased infections, particularly of the respiratory and gastrointestinal tracts. 15% of toddlers in the UK have intakes below the LRNI <sup>6</sup> .

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<b>Vitamins (continued)</b>				
<b>B vitamins</b> Include thiamin, folic acid, niacin (nicotinamide), riboflavin, pyridoxine, biotin, pantothenic acid and cyanocobalamin.	Growth and development of healthy nervous system, skin and mucous membranes in the lung and gastrointestinal tract. Involved in converting food into energy and protein metabolism. Vitamins B6 and B12 are also involved in the formation of red blood cells	Liver pâté and yeast extracts such as Marmite are the only foods that contain all the B vitamins. Most breakfast cereals are fortified with extra B vitamins. Meat, fish, eggs, nuts pulses, flour and cereals	0.5mg/day vitamin B <sub>1</sub> (thiamin). 0.6mg/day vitamin B <sub>2</sub> (riboflavin). 8mg/day vitamin B <sub>3</sub> (niacin). 0.7mg/day vitamin B <sub>6</sub> (pyridoxine). 0.5ug/day vitamin B <sub>12</sub> (cyanocobalamin). 70ug/day folate. Pantothenic acid – no recommendation. Biotin – no recommendation.	Deficiency causes cracked and sore skin in some cases, and anaemia and heart failure. Damage to nerves may result from anaemia due to insufficient vitamin B <sub>12</sub> or folate. Spina bifida can be caused by insufficient folate in early months of pregnancy. B vitamin deficiencies are rarely seen in toddlers in the UK.
<b>Vitamin C (ascorbic acid)</b>	Helps absorption of iron from non- meat sources. Antioxidant that protects cells from damage. Maintains blood vessels, cartilage, muscle and bone. Strengthens immune function and aids wound healing.	Most fruit and vegetables contain some. The richest sources are blackcurrants, kiwi fruit, citrus fruits, tomatoes, peppers and strawberries. Potato, sweet potatoes and mangoes are also good sources.	30mg/day.	Deficiency causes slow wound healing, recurrent infections and bleeding gums. In extremely rare cases vitamin C deficiency can cause scurvy.
<b>Vitamin D</b>	Needed to absorb calcium into the body, and to regulate its movement in and out of the skeleton ensuring strong bones. Part of the immune system	Most vitamin D is made in the skin when toddlers are outside during the summer months i.e. April – September in the UK. It is the ultraviolet sunlight which acts on exposed skin to make vitamin D. Fish cakes or pie made with oily fish, margarine and whole milk. Some breakfast cereals, bread and yogurts have vitamin D added. Formula milks are enriched with it.	Safe Intake is 10ug/day. <sup>7</sup>	Deficiency can cause weakness of the muscles and twitching (tetany), rickets and bone deformities. This is not unusual in the UK especially toddlers of Asian, African and middle-eastern ethnic origins who do not take the recommended supplement.

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<b>Vitamins (continued)</b>				
<b>Vitamin E</b>	Antioxidant that protects cell structures.	In a wide variety of foods. Rich sources are vegetable oils and margarine, avocados, almonds, meat, fish, eggs.	No RNI.	Deficiency very rarely seen in toddlers.
<b>Vitamin K</b>	Blood clotting and bone health. Synthesis of some proteins	Mainly produced by bacteria in the large bowel. Rich food sources are green leafy vegetables and broccoli.	No recommendation.	Tendency to bleed can sometimes be due to deficiency.
<b>Minerals</b>				
<b>Calcium</b>	Bone strength and teeth. Cell structure and function.	Richest sources are milk, cheese, yogurt and fortified soya milk. White bread is fortified with calcium. Biscuits or cakes with ground almonds. Canned fish with bones such as sardines.	350mg/day.	Deficiency can cause fits or bone deformity due to rickets.
<b>Copper</b>	Energy and protein production.	In small amounts in most foods.	0.4mg/day.	Deficiency is very rare in the UK. Fragile bones and increased infections can be effects of deficiency.
<b>Fluoride</b>	Strengthens tooth enamel and helps to prevent tooth decay.	Pea sized amount of fluoride toothpaste on toothbrush when cleaning teeth twice a day provides enough. Supplied by drinking water in areas where tap water is fluoridated or the water naturally contains adequate levels. Water is not fluoridated in Scotland, Northern Ireland and some areas of England.	Safe intake is 0.12mg/Kg body weight/day.	Dental caries are more common with fluoride deficiency. In England 25% of 5 year old children already have some dental decay. <sup>5</sup> Dental fluorosis or brown spots on teeth is caused by excess intake of fluoride. This is usually due to giving too much of a fluoride supplement.

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<b>Minerals (continued)</b>				
<b>Iodine</b>	Part of the hormone thyroxine, which helps convert food into energy and assists general mental and physical development.	Fish, milk and milk products, eggs.	70ug/day.	Deficiency causes impaired brain development and reduced IQ. An enlarged thyroid gland may indicate deficiency.
<b>Iron</b>	Necessary for carrying oxygen around the body in the blood (haemoglobin) and muscles (myoglobin). Also involved in energy metabolism and the immune system.	Best sources are red meat (beef, lamb and pork) and dark poultry meat e.g. chicken legs and thighs. White meat such as chicken breast has less. Other sources are: <ul style="list-style-type: none"> <li>• fortified breakfast cereals</li> <li>• ground or crushed nuts (see back page for caution with peanuts and whole nuts*)</li> <li>• dhal, lentils, hummus</li> <li>• poppadums made with lentil flour</li> <li>• bhajis and Bombay mix made with chickpea flour.</li> </ul> Smaller amounts are in fruit and vegetables. Formula milks are fortified with it.	6.9mg/day.	Iron deficiency causes anaemia, increases susceptibility to infections, lethargy, and delays physical and mental development.  In the latest NDNS survey 10% toddlers had intakes below the LRNI. Over 50% did not meet the RNI. Blood results showed 5% with low Haemaglobin levels and 31% with low Ferritin levels. <sup>6</sup>
<b>Magnesium</b>	Helps bone development, protein production and converting food into energy.	Best sources are wholegrain breakfast cereals, milk and yogurt. Also in meat, egg, dhal, lentils, hummus, potatoes and some vegetables.	85mg/day.	Deficiency can cause muscle weakness, poor growth and neuromuscular function. This is rare in the UK.
<b>Phosphorus</b>	Bone growth and energy metabolism.	Richest source is milk. Present in most other foods.	270mg/day.	Deficiency is rare and only seen in association with other conditions which cause malabsorption.
<b>Potassium</b>	Important for fluid balance, muscle contraction and nerve conduction.	Milk, vegetables and potatoes. Bananas, dried apricots, prunes, dates and kiwi fruit are also good sources.	800mg/day.	A deficiency which causes muscle weakness is rarely seen unless there are kidney problems.

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<b>Selenium</b>	Antioxidant. Production of thyroid hormone.	Brazil nuts. Meat, fish, eggs, and vegetables.	15ug/day.	Heart problems have been linked to selenium deficiency in China but it is rarely seen elsewhere.
<b>Sodium</b>	Important for acid-base regulation, fluid balance and blood pressure.	Salt is the main source so processed foods with added salt such as crisps, bacon, ham, cheese and bread contain the highest amounts. It is also found in meat, milk and yogurt.	500mg/day.	Deficiency is rare but can cause loss of appetite and mental confusion. Excess salt increases thirst and very high amounts can cause fits and death. Chronic high sodium intakes in older children may cause hypertension.
<b>Zinc</b>	Involved in the function of many enzymes. It has a structural role in growth hormone and insulin.	Best sources are meat, fish and shellfish and eggs. Other good sources are milk, wholegrain breakfast cereals such as porridge, Shredded Wheat, Weetabix, and bread. Some in potatoes, dhal, lentils, hummus and leafy vegetables.	5mg/day. This may be set too high and other countries recommend 3mg/day.	A deficiency causes wounds to heal slowly. A skin rash is seen in more severe cases of deficiency.
<b>Phytochemicals</b>				
Substances in plants, which provide long-term protection against cancer and heart disease. Also called flavanoids, flavanols, isoflavones. Examples: lycopene lutein and quercetin.	Important antioxidants and play a part in immune function.	All fruit and vegetables, especially brightly coloured. Cocoa and chocolate.	No recommendation for individual phytochemicals but for adults, five servings of fruit and vegetables per day will ensure adequate intake. Giving toddlers fruit and/or vegetables at each meal will ensure they get enough.	Unknown in toddlers but adults who do not get enough are at higher risk of heart disease and cancer.

## References

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## Further Reading

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**Rice – boiled or fried**  
2–5 tablespoons



**Bread slices (fresh or toasted) – granary**  
½–1 medium slice



**Mashed potato**  
1–4 tablespoons



**Banana**  
¼–1 medium banana



**Broccoli / cauliflower**  
1–4 small florets or  
½–2 tablespoons



**Carrot**  
1–3 tablespoons /  
2–6 carrot sticks



**Processed cheese**  
15–21g (1 slice / 1 triangle or  
string / 1 mini Babybel™)



**Yogurt**  
1 average pot (125ml)



**Custard**  
5–7 tablespoons custard



**Poached / boiled / fried  
egg**  
½–1 egg



**White / oily fresh fish**  
¼–1 small fillet or  
1–3 tablespoons



**Falafels**  
1–3 mini falafels (25g each)



**Fruit (e.g. garibaldi)  
biscuit**  
1–2 biscuits



**Bar of chocolate /  
chocolate biscuit**  
2–4 squares of chocolate



**Digestive (plain) biscuit**  
½–1 biscuit



**Cheese sandwich**  
Cheese sandwich  
(½–1 slice wholemeal bread),  
1–4 cherry tomatoes



**Salmon and vegetables**  
¼–1 small fillet salmon,  
1–4 small florets broccoli,  
2–4 medium potato wedges



**Pasta bolognese**  
3–5 tablespoons pasta  
with bolognese,  
½–2 tablespoons green beans

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