**The main nutrients are proteins, carbohydrates, fats, vitamins and minerals. Each nutrient has a different purpose.**

**Nutrients**

**Proteins**

Fresh fish is a source of protein

Proteins assist with **growth** and **repair** of the body.

Proteins are found in **animal** products like meat, fish, cheese, milk and eggs. **Vegetable** sources include soya-bean products, pulses and nuts.

**Carbohydrates**

Carbohydrates are needed to give the body **energy**. There are two types of carbohydrate - **starch** and **sugar**.

* Starch is found in cereals, cornflour, potatoes, pasta and flour.
* Sugar is found in fruit, vegetables, honey, milk and malt products.

**Fats**

Fats help to provide concentrated sources of **energy** and help to **insulate** the body in cold weather. There are two main types.

* **Saturated fats** are usually obtained from animal sources, for example butter and lard. The exceptions are coconut and palm oils.
* **Polyunsaturated fats** come from vegetable sources, such as sunflower oil.

**Vitamins**

Vitamins are needed in very small amounts for growth and health. The main vitamins are vitamin A, the B complex of vitamins, vitamin C and vitamin D.

**Uses and sources of vitamins**

| **Vitamin** | **Need for** | **Sources** |
| --- | --- | --- |
| Vitamin A | * - good vision * - healthy skin * - growth | * - green and yellow vegetables * - dairy products |
| * Vitamin B * (thiamin, riboflavin and niacin) | * - release of energy from foods * - healthy skin | * - breads * - milk * - eggs |
| Vitamin B12 | * - red blood cells | * - meat * - milk * - fish |
| Vitamin C | * - healthy skin * - protects cells * - helps absorb iron | * - fruit * - vegetables |
| Vitamin D | * - helps absorb calcium * - strong teeth and bones | * - margarine * - oily fish |

**Minerals**

Eggs are a source of calcium and iron.

Minerals are needed in small amounts to help the body function properly and stay strong. **Calcium** and **iron** are two important minerals.

**Calcium**

Calcium is needed for the growth of **healthy teeth and bones**. Sources of calcium include milk, cheese, eggs, wholegrain cereals, green vegetables, bread and tofu.

**Iron**

Iron is needed for the **formation of red blood cells**. Sources of iron include red meat, green vegetables, eggs, lentils and bread.

**Other minerals**

Other minerals that the body needs include potassium, sodium, magnesium and zinc.

**Nutritional properties**

**Starch**

* **thickens** a liquid by forming a *suspension* such as a sauce
* forms a **gel** when the suspension is heated, like adding cornflour to a custard powder and milk mix

**Sugar**

* **flavours** by sweetening
* **colours** by *caramelising* when heated
* *aerates* when beaten with a fat such as in a cake mix

**Proteins**

* can **coagulate** which is when a liquid becomes firmer, for example when an egg is heated
* can aerate a mixture, like whisking egg whites in a meringue mix

**Fats**

* **shortens** pastry (makes it more crumbly) by making it less stretchy
* can act as an *emulsifying agent* to stop two liquids from separating
* **moistens** a baked mixture such as a cake

**Treating foods**

Some foods have different working properties when treated in certain ways. They can be treated by:

* **Aerating** incorporates air by sieving, creaming, whisking, beating, folding and rolling, or rubbing in. **Raising agents** can be used to make a mixture lighter, for example, baking powder is used in cakes.
* **Coagulation** is when something thickens from a liquid to a solid. For example, raw eggs are clear and runny but become white and solid when heated.
* **Preserving** helps food to last longer through freezing, canning, jam-making, or pickling. Fats, sugar and oil are used in preserving.
* **Tenderising** tough meat makes it easier to eat. Lemon juice, vinegar or wine can be used as a marinade, or meat can be tenderised with mechanical action using a meat mallet or slow cooking.
* **Thickening** uses eggs, pulses, cereals and fruit to thicken liquids such as milk, and heat is usually applied. Egg custard is made like this.

**Combining foods**

Most of these working properties can be found in many different foods. The functional properties of different foods can be combined by:

* **Binding** uses fats, eggs, cereals and flour to bind ingredients. For example, egg is used to bind together a biscuit mixture.
* **Bulking** forms the main structure of a food product, such as flour in biscuits and cakes.
* **Enrobing** means coating a food with another ingredient, for example, dipping fish in beaten egg and then breadcrumbs.
* **Enriching** is the addition of an ingredient to improve the quality. Nutrients are sometimes added to increase nutritional value.
* **Fermentation** uses yeast to convert carbohydrates into alcohol and carbon dioxide. In bread making, yeast is added to flour and water causing the dough to rise.
* **Flavouring** can be savoury, like herbs and spices, or sweet, like sugar or sweeteners. Sugar helps to soften the sharp taste of grapefruit.
* **Shortening** uses of oils and fats to reduce the development of gluten in pastry to make the dough less stretchy.
* **Stabilising** helps food keep its structure. Eggs and flour are used for stabilising.
* **Setting** means using ingredients to make foods firm, such as gelatine to set cold desserts.

**Food structures**

When ingredients are combined they can form many different kinds of mixture or structure.

* **Solution** is when one substance is dissolve in another one, for example when sugar is dissolved in water we get a sugar solution.
* **Colloid** is a general term for when two substances are mixed together. For example milk has a colloidal structure, because it is made from microscopic drops of fat dispersed in a water-based liquid.
* **Emulsion** is when two unblendable liquids are mixed together, for example, oil and vinegar. An emulsifier like egg yolk is needed to stop them from separating. Emulsions are a particular type of colloid. Mayonnaise is an emulsion.
* **Foam** is when air bubbles are incorporated into a liquid, such as in whipped cream and meringue
* **Gel** contains a small amount of a solid in a large amount of liquid. A small amount of gelatine can set a large amount of liquid.
* **Suspension** is when a solid is held in a liquid. The solid may sink if the mixture is not stirred. Flour (solid) is suspended in milk (liquid) when making a cheese sauce.

**Additives**

Food additives can be classified as natural or artificial.

**Natural additives** occur naturally in foods. They are extracted and put into other foods. Caramelised sugar is used as colouring in cola.

**Artificial additives** do not occur naturally. They are made synthetically for a certain purposes. For example tartrazine is a synthetic colouring added to some sweets to make them yellow.

**Uses for additives**

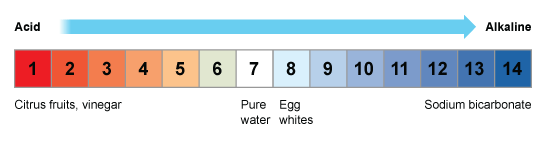
Both natural and artificial additives are used for many different reasons:

* **Preservatives** extend the shelf life of a product. Salt is used used in bacon and sausages.
* **Colouring** makes food products look more appealing and appetising.
* **Flavourings** can be used to add or improve the flavour of a food product. Vanilla flavouring is often added to cakes and biscuits.
* **Emulsifiers** are used to prevent ingredients from separating. For example, lecithin, which is found in eggs, is used to stop the ingredients in mayonnaise from separating.

**Foods can be acidic, alkaline or neutral. The rate a food deteriorates is determined by acidity and temperature. Foods must be reheated properly to prevent food poisoning.**

**Food acidity**

**Acidity** or **alkalinity** of food is measured on the **pH scale**, which runs from 1 to 14. A strong acid will have a pH of 1, and a strong alkali will have a high pH value, like 14.



Some foods, such as citrus fruits, are acidic. Others, like sodium bicarbonate, are alkaline. Foods that are neither acid nor alkaline, like pure water, are called **neutral** and have a pH value of 7.

Acidity or alkalinity affects:

* the taste of final product
* the rate at which microorganisms grow within and upon food

**Examples**

Acidity or alkalinity can affect food in the following ways:

* Acidic fruit mixed with milk will cause the mixture to curdle.
* Vinegar (acid) is added to meringue to give it a soft marshmallow texture.
* Bicarbonate of soda (alkaline) acts as a raising agent during baking.
* Lemon juice (acid) helps prevent fruits like apples from discolouring.
* **Food temperature**
* **Microorganisms in food**
* **Bacteria**, **mould** and **yeast** are all types of *microorganism*. They cause food to change, sometimes making food unpalatable.
* Heating and cooling can make food less resistant to microorganisms. This affects its ability to stay fresh.
* **Chilling**
* Dairy produce, cooked foods and raw ingredients should be kept at a temperature **between 0°C and 5°C**. This will slow the growth of microorganisms, but won't stop it.
* **Freezing**
* Meats, vegetables and ready meals can be frozen. Freezing maintains high standards of freshness and safety. Freezers store products at **-18°C or below**. Freezing does not kill microorganisms, but will keep them dormant until the food is unfrozen.
* **Reheating foods**
* Food must be reheated to **at least 72°C** to avoid the risk of food poisoning. Leftovers should be disposed of quickly.

**Ranking tests**

Similar products are tested for a specific characteristic, for example saltiness. Samples are given randomly coded names, and testers sort the products from most to least salty.

**Rating tests**

Products are tested for a specific characteristic to find out if there is a noticeable difference between two products. For example, manufacturers can test a new low fat version of a product to see if it is similar to the original. The products are randomly coded and testers rate them using a scale

**Manufacturing specification**

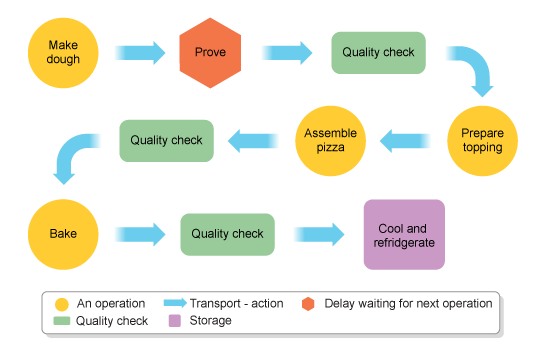
The **manufacturing specification** lists information a manufacturer needs to produce the product. The specification records the stages of the production process, with details of all the **characteristics** (shape, size, texture, colour, flavour etc) required in the final product.

It also lists where **standard components** can be used. A standard component is a pre-prepared ingredient used in the production of a food product, like pizza bases or ready-made sauces.

**Quality control checks will normally include:**

* **weight checks** to make sure the product is the required weight
* **visual checks** to make sure it looks the way it should
* **temperature checks** to make sure it is being kept at an appropriate temperature
* **pH checks** to make sure the food has the correct acidity/alkalinity
* **microbiological checks** to make sure bacteria are not at harmful levels
* **chemical checks** to guard against chemical contamination
* **metal checks** to guard against contamination by metals (usually at the packing stage, using a metal detector)
* **organoleptic checks** to check flavour, texture and aroma by sampling the food product

This flowchart shows where quality checks might take place during the production of pizza:

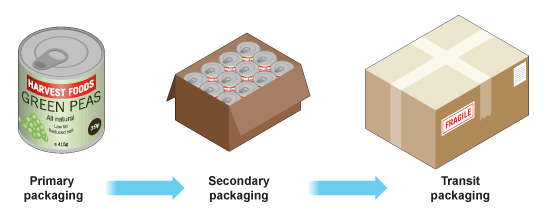


* to preserve the product
* to protect the product from damage
* to make the product more attractive to the consumer
* to make it easier to transport the product

**Environmentally friendly** packaging causes less damage to the environment. There are three types:

* **Reusable packaging** can be cleaned and re-used. For example, glass milk bottles are reused.
* **Recyclable packaging** is made of materials that can be used again, usually after processing. Recyclable materials include glass, metal, card and paper.
* **Biodegradable packaging** will easily break down in the soil or the atmosphere.

Recyclable packaging should carry standard symbols that show what the product is made from and how it can be recycled.

**Layers of packaging**

ing.

* **Primary packaging** is seen at the point of sale. It needs to contain and protect the food product, as well as display it and provide information.
* **Secondary packaging** is the middle layer of packaging - for example a cardboard box with a number of identical products inside.
* **Transit packaging** is the outer container that allows easier handling during transfer between factory, distribution centres and retailers

**Labelling**

The **Food Labelling Regulations** of 1996 require certain information to be given on all pre-packed foods. These requirements are written by the EU.

**These are the items on the label that are required by law.**

* manufacturer's name and contact details
* name of the product
* description of the product
* weight (some foods are exempt, for example bread)
* ingredients (listed in descending order of weight)
* cooking/heating instructions
* storage instructions
* shelf life
* place of origin
* allergy information

The Food Standards Agency devised a **traffic light** system to make it easier for consumers to know the nutritional content of food.

**Social, environmental and ethical factors affect the foods that consumers buy. Diets can be affected by allergies and intolerances. A balanced diet is needed to prevent health problems.**

**Social factors**

**Social factors** are things that affect **lifestyle**, such as religion, family or wealth. These can change over time. Food developers need to be aware of these changes to make foods that meet the needs of consumers.

For example, consumers now expect to find a wide range of foods. This is because:

* communities are more **multicultural**, meaning they are made up of different races and religions, often with their own traditional cuisines
* TV cookery programmes encourage people to try new foods
* increased travel abroad means exposure to new foods
* improved transportation and technology means less reliance on local or seasonal produce

**Environmental and ethical factors**

Food choices can be based on environmental and ethical factors.

**Environmental factors**

**Environmental factors** are things that help reduce the impact of food production on the environment and might cause someone to choose to buy a product. For example, locally produced food doesn't have to be transported as far, so less CO2 is produced. This means there is less of an impact on the environment.

**Ethical factors**

**Ethical factors** are things that can be seen as morally right. For example, buying fair trade food which provides farmers with better working conditions.

**Examples**

Some environmental and ethical factors are:

* **Fair trade** food production aims to provide fair prices and better working conditions for farmers and farm workers.
* **Farm assured** means that the farms and food companies meet high standards of food safety and hygiene, animal welfare and environmental protection.
* **Food miles** means the distance that food travels from where it is grown to where it is bought. This is an environmental concern because of the CO2 emissions from transport.
* **Free range** is a method of farming where animals are allowed to roam freely.
* **Genetically modified** food is grown with genetic manipulation technology. Some people consider this a risk to the environment and choose GM-free products.
* **Organic** foods have been grown without the use of chemical fertilisers or pesticides.
* **Seasonal** foods means foods that are in season. Choosing these reduces food miles
* **Sustainability** is food production that aims to preserve the world's natural resources for future generations.

**Diets**

Diets can be adopted for **health reasons** such as allergies, intolerances or needing to lose weight. Examples of diets are:

* **Calorie controlled** - food energy is measured in calories. Keeping calorie consumption below the energy your body uses up causes weight loss.
* **Coeliac disease** - an intolerance to **gluten**. Gluten is found in foods containing wheat, eg bread, cakes, and pasta.
* **Diabetes** - is where blood sugar level is higher than normal. Diabetics need to monitor carbohydrate intake.
* **Lactose intolerance** - is an inability to absorb the sugar that naturally occurs in cow's milk.
* **Nut allergy** - means a sensitivity to nuts, causing a reaction which can be severe.
* **Vegetarian** - means not eating meat and fish. Protein must be obtained from dairy products, nuts and pulses.

**High fibre diet**

Fibre or **non starch polysaccharide (NSP)** is not absorbed by the body but is needed to help maintain a healthy digestive system. There are two types of fibre:

**Soluble fibre** - found in fruit, vegetables, pulses and oats. It helps to reduce blood cholesterol.

**Insoluble fibre** - found in cereal such as bread and pasta. It helps to stimulate the digestive system.

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**Healthy eating guidelines**



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[**Enlarge image**](http://www.bbc.co.uk/schools/gcsebitesize/design/images/fd_eatwell_large.jpg)

The **eatwell plate** shows the proportions of food groups that should be eaten daily in a well-balanced diet.

It shows a healthy diet should be high in fruit and vegetables, and starchy foods like bread and pasta. A smaller amount of dairy products like milk and cheese, and sources of protein such as meat or fish are also needed. Foods that are high in sugar or fat, like chocolate and crisps, are needed in a much smaller quantity.

**Effects of an unbalanced diet**

An unbalanced diet includes **too much or too little** of the recommended food groups. This can lead to health problems, such as:

* coronary heart disease
* high blood pressure
* obesity
* tooth decay

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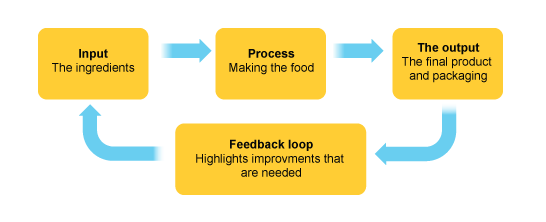
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**Production systems consist of inputs, processes, outputs and feedback. There are different scales of food production that require different kinds of equipment. CAD and CAM can be used to design, test, and monitor processes. Standard components can be used to speed up production. Safety is ensured through hazard analysis and critical control point checks.**

**Production systems**

The production process can be viewed as a system, incorporating the following elements:



* **Inputs** are everything that goes into the system, such as the ingredients.
* **Processes** include weighing, mixing, shaping and forming of mixtures, cooking, cooling, and packaging. Checks are carried out throughout the process.
* **Output** is the end product, complete with packaging.
* **Feedback** can happen throughout the production process. Control checks flag up the need for alteration and improvement to the inputs or processes.

**Computer aided manufacture**

**Computer Aided Manufacture (CAM)** efficiently controls and monitors production using computers. Multiple processes can be carried out at the same time.

**Examples**

CAM is used to:

* monitor temperature
* monitor weight
* check pH
* control conveyor belt speed
* monitor quantities of ingredients

**Advantages**

* more consistent results
* reduces labour costs
* improves accuracy, reducing waste
* faster for high-volume production
* improved saftey and hygiene
* easier monitoring

**Disadvantages**

* expensive to set up
* needs skilled operators
* can be slower for one-off or low-volume production
* **Equipment**
* A range of electrical and mechanical equipment is used to make sure that products are **consistent**, or to reduce the **time and effort** required.
* **Equipment used and purpose**

| **Name** | **Purpose** |
| --- | --- |
| Electronic scales | Weigh food accurately |
| Depositor | Put exact amounts of ingredients into different containers at the same time |
| Mandolin | Slice food portions equally |
| Food processor | Blends and mixes ingredients |
| Hand blender | Used to purée food eg in soups |
| Dough hook | Mixing and kneading dough |
| Electric whisk | Whisks ingredients saving time and effort |
| Cutters | Ensure food is the same shape and size eg biscuit cutters |
| Temperature probe | Check temperatures in high risk foods |
| Tunnel oven | Ensures continuous even cooking using a conveyor belt |
| Deck oven | Cooks a batch of several foods at the same time |
| Boiling vats | Huge drums used for cooking liquids eg soups, chocolate |
| Date-stamping machine | Label packaged food with a date stamp |

