

HEALTH & FOOD
TECHNOLOGY
HIGHER

FOOD PRODUCT
DEVELOPMENT

THE FUNCTIONAL
PROPERTIES OF
INGREDIENTS



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Functional Properties Of Food

To produce variety in products, both in industrial and domestic food processing, knowledge of the qualities or properties a food possesses is essential. To create a successful product, food technologists need to apply their knowledge of the properties of food used as ingredients in a product.

The qualities a food possesses depend on the physical and chemical nature of the product. These qualities are called **properties**.

What happens to food during processing depends on these properties. To make successful products, food technologists use these properties and they are described as **functional properties**.

Eggs

FUNCTIONAL PROPERTY	HOW IT WORKS	WHAT IT'S USED FOR
Aeration	When eggs are beaten they form a foam which traps air, which makes baked products lighter.	Meringues, whisked sponges, cakes
Emulsification	Egg yolk acts as an emulsifier which prevent mixtures from separating and curdling	Mayonnaise, cakes
Coagulation	When eggs are heated the protein coagulates which changes from a fluid to a solid. This can thicken or set baked products, if over- heated the protein shrinks resulting in a tougher watery product (scramble eggs)	Egg custard, quiche, bread and butter pudding
Binding	The egg protein coagulates when heated which helps to bind or hold ingredients together.	Meatballs, hamburger and biscuits
Flavour	Eggs add a rich flavour to baked products.	Biscuits, pastry and cakes

Flour

FUNCTIONAL PROPERTY	HOW IT WORKS	WHAT IT'S USED FOR
Gelatinisation	When starch and water are heated, the water is absorbed by the starch granules, which swell and burst causing the liquid to thicken.	Cheese sauce, custard, white sauce.
Fermentation	Yeast produces carbon dioxide and alcohol which allows the flavour texture and volume to develop. When dough is cooked the gluten is stretched by the bubbles of co2 gas and the bread rises.	Bread, pizza bases.
Dextrinisation	The surface starch in baked items changes to dextrin during cooking, which helps baked goods become golden brown in colour.	Bread, cakes, biscuit, toast.

Sugar

FUNCTIONAL PROPERTY	HOW IT WORKS	WHAT IT'S USED FOR
Crystallisation	When sugar is dissolved in water and then boiled the water is driven off resulting in thick syrup being formed. This set to crystals when cooled. The mixture should not be stirred as this will result in a crunchy mixture. The sugar prevents food spoilage as it acts as a preservative.	Jams making, sweetie making, tablet and toffee
Caramelisation	When sugar is heated in a liquid or used as a topping it begins to caramelize and turn brown due to the heat. It will burn if heated for too long.	Cakes, tablet, toffee, crème caramel.
Aeration	Sugar traps air when creamed with fat making the end result lighter in texture. Sugar helps yeast to rise in bread making.	Cakes, bread.
Colour	Sugar can give a golden brown colour to baked products	Biscuits, pastry and cakes

Fat

FUNCTIONAL PROPERTY	HOW IT WORKS	WHAT IT'S USED FOR
Aeration: Creaming	When beaten together, fat and sugar form a foam which traps air and makes the baked product lighter	Cakes and biscuits
Rubbing In	When fat is rubbed into flour it coats the flour particles which forms a waterproof barrier and traps air	Pastry, cakes, biscuits
Shortening	When fat is rubbed into flour it coats the flour particles, but some remain uncoated. When water is added the uncoated particles absorb the water which is why fats make baked products crumbly (or short)	Pastry, shortbread
Colour	Butter can give a golden brown colour to baked products	Biscuits, pastry and cakes
Flavour	Butter adds a rich flavour to baked product	Biscuits, pastry and cakes

LIQUID (Water, Milk)

FUNCTIONAL PROPERTY	HOW IT WORKS	WHAT IT'S USED FOR
Aeration	Liquids help baked products to rise as they produce steam when heated in the oven. Yeast (used in bread) needs liquid in order to grow.	Cakes, biscuits, bread
Gelatinisation	When starch and water are heated, the water is absorbed by the starch granules, which swell and burst causing the liquid to thicken	Cakes, Cheese sauce, custard, white sauce
Nutritional Value	Using milk as a liquid in a baked product will add protein and calcium to the dish.	Mashed potato, custard, cheese sauce
Colour	Milk can give a golden brown colour to baked products	Rice pudding, egg wash on scones
Flavour	Milk add a rich flavour to baked product	Muffins, sauces

The Proportion of Ingredients

Manufacturers combine foods in different combinations to obtain a successful product. The constant need to develop products that meet dietary targets and goals encourages food manufacturers to change the standard proportions of ingredients.

Eggs

<i>Too little egg in a product</i>	<i>Too much egg in a product</i>
<ul style="list-style-type: none"> • gives a dry result • gives less flavour • gives a paler colour 	<ul style="list-style-type: none"> • gives an “eggy” flavour • Gives a more solid end result

Flour

<i>Too little flour a product</i>	<i>Too much flour in a product</i>
<ul style="list-style-type: none"> • Cakes may not rise • Biscuits may not set or may spread in the oven • Sauce will not thicken or be too runny 	<ul style="list-style-type: none"> • gives a dry result • product will be too dense and heavy • the sauce may me too thick, almost like a gel

Sugar

<i>Too little sugar in a product</i>	<i>Too much sugar in a product</i>
<ul style="list-style-type: none"> • gives less flavour • gives poorer keeping qualities • gives a paler colour • results in the product not rising so well 	<ul style="list-style-type: none"> • results in a longer cooking time • gives a darker colour • gives some foods a sugary texture • produces very soft mixtures during baking, which will then become hard when cool • gives a sweeter result • fruit may sink in fruit cake/cake may sink in middle

Fat

<i>Too little fat in a product</i>	<i>Too much fat in a product</i>
<ul style="list-style-type: none"> • gives a less moist result • affects the keeping qualities • the product will become stale more quickly • gives less flavour • gives a paler colour • pastry may be hard and tough 	<ul style="list-style-type: none"> • gives a greasy result • improves the flavour • gives a darker colour • product may be very crumbly/fall apart

LIQUID (Milk And Water)

<i>Too little liquid in a product</i>	<i>Too much liquid in a product</i>
<ul style="list-style-type: none"> • gives a dry texture • may not rise well • pastry may be very crumbly and fall apart • sauces will be too thick 	<ul style="list-style-type: none"> • bread having a coarse, open texture • scones being too soft and losing shape when cooking • cakes having a heavy, doughy texture • cakes with a cracked top • fruit sinking in a fruit cake • hard and tough shortcrust pastry • sauces being too thin

Processing And Cooking Of Ingredients

The mixing of ingredients and cooking may change the end result e.g. A cake baked at a LOW temperature for a LONG time will be paler than one cooked at a HIGH temperature for a SHORT time.

Process	Food(s)	What happens	Reason
Whisking	Egg white Eggs and sugar	Increases in size. Thick, pale yellow stable foam is formed.	The protein stretches to hold air, trapping small bubbles in a foam. Large bubbles become very small bubbles and are trapped inside a very fine honeycomb mesh.
Whipping	Cream	Thickens	Fat globules start to stick together until cream becomes thick.
Rubbing in	Scones Pastry	Air is trapped during mixing	Fat rubbed into flour particles will form a waterproof barrier and will also trap air.
Creaming	Cakes	Air is trapped into mixture.	Fat and sugar form air-in-fat foam. The small crystals present in the fat are separated by the abrasive action of gritty sugar. Individual fat crystals surround the tiny air bubbles and trap the air in the mixture.
Kneading	Bread/rolls	Air is trapped in the dough Gluten is developed in the dough Chains of yeast cells are broken up.	Produces a light product. Produces good volume Produces an even texture.

Cooking:

- When a carbohydrate is heated with protein, a series of reactions can occur, resulting in browning e.g. cooking of meat, and the baking and toasting of breakfast cereals and toasted nuts. The products are more appetising as a result.
- Boiled green vegetables are bright green at the beginning of cooking. They then become dark olive green then brown as they are overcooked. Manufacturers who produce prepared vegetables dishes have to consider this fact when advising consumers on reheating their products.
- The cooking method used will affect colour. When food is grilled or baked it turns brown due to dextrinisation, caramelisation or browning. The colour changes very little when food is microwaved or steamed.
 - When hard-boiled eggs are to be sliced and used in salads, they must be carefully cooked to the required time. The egg white changes from an opaque colour to white but a green/black ring may form around the yolk but can be partly prevented by cooling the egg quickly after cooking.