



Understanding Food Products

Lesson 1: What's in food, and why?

Introduction

Hello and welcome to the first lesson in Understanding Food Products entitled What's in food and why?

In this lesson we will see the function of the main ingredients in food and the role of nutrients in relation to food science.

We will:

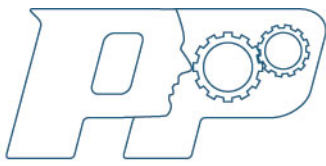
- Examine what Food Science is and the scientific disciplines involved in this complex subject
- Look at the function of ingredients in food, bringing the ingredients that go in a baked cake as an example
- Look at the major commercial food ingredients, including cereals and grains, fruits, vegetables, pulses, meat, fish, dairy and their derivatives
- Understand nutrients and their classification into macronutrients, which include carbohydrates, fats and protein, and micronutrients, which include minerals and vitamins.

Definition of Food Science

First of all, let's start with the definition of Food Science.

Food Science is the discipline in which biology, chemistry, physical sciences and engineering are used to study the nature of food, the causes of their deterioration and the principles underlying food processing.

When we think of the science behind the food we buy, cook and eat we need to consider:



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Biochemistry – as the interactions between our body and the food we ingest (for example what the macro- and micro- nutrients do to our organs and systems)

Microbiology – as all the micro-organisms involved in food processing but also involved in the digestion of the food

Chemistry and physics – as they govern all the reactions between atoms and molecules during processing of food

Engineering – which is involved in food processing, food machinery, packaging, ingredient manufacturing, instrumentation and process control

Regulations – as production, trade and handling of food have to be strictly regulated to guarantee food control, food safety and fair food trade

Technology – the application of food science to the selection, preservation, processing, packaging, distribution, and use of safe food

Sensory evaluation – which is a scientific discipline used to analyse reactions to stimuli perceived through the senses – Sight, Smell, Touch, Taste and Sound.

Sensory analysis is a vital tool for the food industry and can be used in a number of applications, such as new product development and quality control and assurance

So, what is in food and why?

What is the function of food products?

To answer these questions, we need to examine the ingredient lists of processed food and look at what is in unprocessed foods.

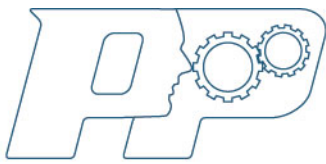
And to understand the functions of ingredients in food stuff we will need some chemistry, which has a big role in determining food properties, such as hydration and sensory properties, and food applications, such as emulsion, foams, etc. We will cover the basics of food science in a later lesson.

Every ingredient has very specific functions: think for instance about the ingredients that go in a cake:

Flour holds ingredients together. It also contains a protein that, when combined with moisture and heat, develops into gluten to give the cake elasticity. Different types of flours have different levels of gluten and therefore they are suitable for different types of baked goods.

Baking Powder is a leavening agent, that is it causes your batter mixture to rise or expand.

Baking Soda is another type of leavening agent, but it needs to be paired with an acidic ingredient like honey, chocolate, or yogurt to make the batter rise.



Butter is a solid fat, that also helps in leavening and adds moisture. It also adds flavour and has a great role in mouthfeel.

Eggs do a lot in baking, but most importantly they add volume and work as binder, meaning they keep the finished product together. You can use the whole egg, for flavour, binding, thickening, or glazing, or you can use egg whites and egg yolks for separate things. Egg whites are a drying agent, and add moisture and stability, while egg yolks contribute to texture and flavour.

Milk contains proteins that soften the batter, contribute to moisture and add colour and flavour to the final product. Milk has the double function of giving the dough or batter strength and structure, as well as adding tenderness, flavour and moisture.

Salt does a couple different things in baking. For one, it helps preserve the colour and flavour of flour. In bread, it controls the fermentation rate of yeast, and strengthens the gluten protein in dough. Though it seems salt is out of place in sweet recipes, it also enhances flavour.

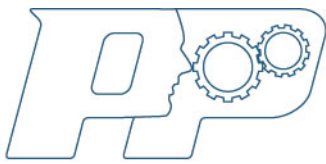
Sugar is performing a number of functions you're probably not aware of. For one, it adds texture, like keeping your baked foods soft and moist. It is also yet another leavener, though working in conjunction with fat, eggs, and liquid ingredients. Sugar sweetens by the sugar caramelizing in the recipe, and adds that "crunch" to the crusts of cakes and cookies.

Major commercial food ingredients

Now let's have a look at the major classes of ingredients employed in commercial food products.

Cereals and grains – A cereal is any of the edible components of the grain of cultivated grass, such as wheat, rye, rice, corn, oat, millet, and many others. These grains are composed of the endosperm, germ, and bran. Often, the words cereal and grain are used interchangeably. There are also pseudograins that are often called grains but are not cereals: the three majors are amaranth, buckwheat, and quinoa.

Vegetables and derivative – Vegetables are parts of plants that are consumed by humans or other animals as food. The original meaning is still commonly used and is applied to plants collectively to refer to all edible plant matter, including the flowers, fruits, stems, leaves, roots, and seeds. Based on their nutrient content, vegetables are organized into 5 subgroups: dark-green vegetables, starchy vegetables, red and orange vegetables, beans and peas, and other vegetables.



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Fruits and derivatives – Fruits are the means by which flowering plants or angiosperms disseminate seeds, but in common language usage, "fruit" normally means the fleshy seed-associated structures of a plant that are sweet or sour, and edible in the raw state.

Pulses and derivative – A pulse is an edible seed that grows in a pod. Pulses include all beans, peas, chickpeas and lentils. They fall under the legume family, but the word "pulse" specifically refers to legumes that are grown and harvested for their dry seed and grown as food.

Meat and derivative – Meat is animal flesh that is eaten as food. The advent of civilization allowed the domestication of animals such as chickens, sheep, pigs and cattle. This eventually led to their use in meat production on an industrial scale with the aid of slaughterhouses. White meat includes poultry and fish, but excludes all mammal flesh, which is considered red meat.

Fish and derivative – Many species of fish are consumed as food in virtually all regions around the world. Fish has been an important source of protein and other nutrients for humans from time immemorial. In culinary and fishery contexts, fish may include shellfish, such as molluscs, crustaceans and echinoderms.

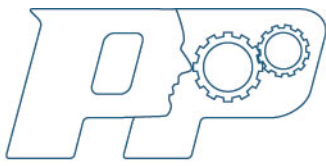
Dairy products – Dairy products, milk products or lacticinia are a type of food produced from or containing the milk of mammals, primarily cattle, water buffaloes, goats, sheep, camels, and humans. Dairy products include food items such as yogurt, cheese, butter and dairy spreads.

Food additives – Food additives are substances added to food to maintain or improve its safety, freshness, taste, texture, or appearance. They are substances not normally consumed as a food in itself and not normally used as a characteristic ingredient of food. Food additives need to be checked for potential harmful effects on human health before they can be used. They include emulsifiers, stabilisers, anti-oxidants, thickeners, preservatives and salt.

Nutrients

But the main role of food, is to provide our body with all the nutrients it requires for its functions, health and growth.

We divide nutrients in two main classes: macronutrients and micronutrients. The difference between them is that macronutrients are required by the body in larger quantities – macro originated from Greek makros, meaning large, whereas micronutrients are needed in smaller quantities – as the word micro originated from Greek mikros, small, would suggest.



Macronutrients are needed in larger quantities because they are the main source of energy to our body, energy that is measured in the form of calories and is essential for the body to grow, repair and develop new tissues, conduct nerve impulses and regulate life process. Macronutrients include carbohydrates, fats and protein.

Carbohydrates are the body's main source of energy. Some organs, like the brain, work entirely on carbohydrates as a source of energy. They provide 4 calories per gram and they form the major storage of energy for later use. The three main forms of carbohydrates are sugars, starches and fibres.

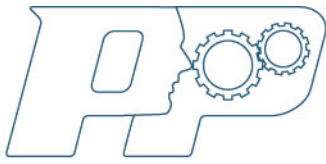
Fats are used in making steroids and hormones and serve as solvents for hormones and fat soluble vitamins. Fats have the highest caloric content, about 9 calories per gram, and provide the largest amount of energy when burnt. Extra fat is stored in adipose tissue and is burnt when the body has run out of carbohydrates.

Proteins provide amino acids and make up most of the cell structure including the cell membrane. They are the last to be used of all macronutrients. In cases of extreme starvation, the muscles in the body, that are made up of proteins, are used to provide energy.

Micronutrients, instead, are required in very minute amounts and do not function for the provision of energy, but are extremely important for the normal functioning of the body. Their main function is to enable the many chemical reactions to occur in our body. Micronutrients include minerals and vitamins.

Minerals – are found in ionized form in the body. They are further classified into macrominerals and microminerals (or trace minerals). Macrominerals present in the body include Calcium, Potassium, Iron, Sodium and Magnesium to name a few. Iron is a constituent of Haemoglobin which is present in blood. Macrominerals are needed in more amounts, as compared to microminerals. Microminerals include Copper, Zinc, Cobalt, Chromium and Fluoride. They are mostly co-factors, and are necessary for the function of enzymes in the body, but are needed only in minor quantities. Approximately 4% of the body's mass consists of minerals.

Vitamins – are essential for normal metabolism, growth and development, and regulation of cell function. They work together with enzymes and other substances that are necessary for a healthy life. Vitamins are either fat-soluble or water-soluble. Fat soluble Vitamins can be stored in the fatty tissues in the body when in excess. Water soluble vitamins are excreted in urine when in excess and so need to be taken daily. Water soluble vitamins include Vitamin B and C. Green leafy vegetables are rich in Vitamin B, whereas Vitamin C is found abundantly in citrus fruits. Fat soluble vitamins are Vitamin A, D, E and K. Green leafy vegetables, milk and dairy products and plant oils provide these vitamins.



Another very important substance, that doesn't fall in any of the above categories, but is essential for our life is water. Water makes up a large part of our body weight and is the main component of our body fluids. The body needs more water every day than any other nutrient and we replenish it through foods and liquids we eat and drink. Water serves as a carrier, distributing nutrients to cells and removing wastes through urine. It is also a compulsory agent in the regulation of body temperature and ionic balance of the blood. Water is completely essential for the body's metabolism and is also required for lubricant and shock absorber.

Summary

In this lesson we learnt:

- What Food Science is and the scientific disciplines involved in this complex subject
- The function of ingredients in food, bringing the ingredients that go in a baked cake as an example
- The major commercial food ingredients, including cereals and grains, fruits, vegetables, pulses, meat, fish, dairy and their derivatives
- Nutrients and their classification into macronutrients, which include carbohydrates, fats and protein, and micronutrients, which include minerals and vitamins.