

CHAPTER 6

Food, nutrition and health in France

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Introduction

Traditional food products are an important part of French Culture, identity and heritage. French cuisine has evolved over time as a result of social and political changes in the country. It was codified in the 20th century by Auguste Escoffier to become the modern reference in terms of fine cuisine. It still has an international reputation for its diversity and refinement. It is one of the symbols of the country. That's why since 2010, **the gastronomic meal of the French** is inscribed on the Representative List of the Intangible Cultural Heritage of Humanity. It is described as follows:

The gastronomic meal of the French is a customary social practice for celebrating important moments in the lives of individuals and groups, such as births, weddings, birthdays, anniversaries, achievements and reunions. It is a festive meal bringing people together for an occasion to enjoy the art of good eating and drinking. The gastronomic meal emphasizes togetherness, the pleasure of taste, and the balance between human beings and the products of nature. Important elements include the careful selection of dishes from a constantly growing repertoire of recipes; the purchase of good, preferably local products whose flavors go well together; the pairing of food with wine; the setting of a beautiful table; and specific actions during consumption, such as smelling and tasting items at the table. The gastronomic meal should respect a fixed structure, starting with an apéritif (drinks before the meal) and ending with liquors, containing in between at least four successive courses, namely a starter, fish and/or meat with vegetables, cheese and dessert. Individuals called gastronomes who possess deep knowledge of the tradition and preserve its memory watch over the living practice of the rites, thus contributing to their oral and/or written transmission, in particular to younger generations. The gastronomic meal gathers circles of family and friends closer together and, more generally, strengthens social ties.

With Mexican cuisine and the Mediterranean diet, registered on the same day, this is the first time that culinary traditions have been inscribed in this list.

The French devote a veritable cult to dishes and cooking. The meal is a ritual of happiness. The French cuisine is very varied; each region has its own specialties. The French gastronomy and the French traditional products have evolved along the French history influenced by the diverse geographical landscape. Many typical products are associated with traditional and religious celebrations.

An overview of benefits, adverse properties and preservation of these French foods are also described in this chapter.

Historical overview

Modern French Gastronomy is a combination of haute cuisine and the cuisines of France's regions. However, this was not always the case. French cuisine has been changing over the years.

This part was written based on the book of [Poulain and Neirinck \(2004\)](#).

The Middle Ages

The Middle Ages was a century of food insecurity for the countryside due to the ravages of war, lootings and famines. The peasants' diet was mainly made up of oatmeal, pork and tubers. The meat was more expensive and therefore more prestigious and was found only on the tables of nobility. In the cities but also in the countryside smoked fish was very much appreciated such as herring. A wide variety of river fish were also eaten. But the Middle Ages is particularly well known for these feasts, an occasion for the aristocracy to assert its social status through the consumption of expensive and distant products such as spices and also wild game. The very important use of spices had a double use, that of

masking rancid tastes and that of social distinction. The feasts of this time are structured in several services composed of a set of dishes that were placed on the table at the same time. The number of services could vary from 2 to 6 depending on the importance of the meal.

The Renaissance

The Renaissance was the period of major change in food history. In the middle of the 16th century, France allied itself with the Medicis, and the Florentines revolutionized all the arts, including culinary art.

The discovery of America brought new ingredients on the tables: peas, tomatoes, corn, peppers, coffee, chocolate, turkey and potatoes. The Renaissance was also the time of baking; paste, jams and sweets. Many pies date from this period, rice cake, gingerbread, cabbage paste, spoon cookies, candied flowers (ancient violet sugar), candied fruit peel, nougat and ice cream. The main Italian influence was not only in the cuisine, but also on service, tableware and eating habits. There was the appearance of forks, individual plates and glasses imported from Murano which replaced the cups of vermeil, silver or tin.

In the countryside, more meat of all kinds is eaten, especially offal including veal liver, a wide variety of fruits, salads and cheeses from all regions. At the Court, in comparison with the Middle Ages, there was a decrease in meat consumption and an increase of vegetable consumption.

The 17th century

The 17th century, called the « Grand Siècle », was also known for its gastronomy. The “culinary revolution” is marked by the reign and personality of Louis XIV. During this century, the taste for spices declined, as the democratization of spices in the markets of the cities trivialized its consumption and princely tables replaced them with aromatic plants such as thyme, bay leaves, parsley, the origin of our bouquet garni and chives, tarragon and rosemary. At that time, stews and sauces as well as juices and coulis appeared. This culinary century is also marked by the increasingly massive use of vegetables, the taste for salads and fruit. We also see the appearance of mousses to allow “to eat without having to attend the coarse and prosaic spectacle of chewing”. Tea, coffee and chocolate became fashionable drinks. The first café opened in 1674 under the name “Le Procope” in Paris and became the privileged place of writers and philosophers. Pierre Pérignon dit Dom Pérignon, a Benedictine monk and oenologist of this century, played a major role in the blending and elaboration of champagne, which would delight the royal tables in the 18th century.

For the people, this century in which taxes are very high, leads to the depletion of food. Cereals are not only consumed in the form of baked breads, but also in the form of porridge. This soup is a “boiled water” in which are immersed “herbs” and “roots”, carrots and turnips, leeks, blueberries, spinach, parsnips, onions and especially cabbage,

and legumes such as beans, lentils or peas. At best, the soup is seasoned with a piece of bacon cut from salted pork. Meat is scarce, except on festive days, as well as cod and herring on certain days. As for poultry, eggs, butter and wine, they were brought to the market in order to earn a few coins needed to pay the royal tax.

The 18th century

The 18th century was a time of culinary renewal: cooking became a science and we then speak of new cuisine as opposed to old. The time great changes will take place in mentalities, good taste, the art of receiving, the use and diversification of food, the arrangement and structure of kitchens.

At the end of the 18th century came the French revolution, which led to major political, economic and cultural changes in France. The agricultural revolution and mechanization took off, industry developed and the bourgeois class emerged. From then on, cuisine and tableware became an essential sign of social belonging. It is therefore possible to distinguish in the 18th century three types of kitchens: bourgeois, domestic and farm kitchens. The success of the restaurants is related to the advent of a gastronomic literature spreading the forms and background of haute cuisine contributing to its influence in the world.

The 19th century

The 19th century was the golden age of potatoes. Ignored until then, it became one of the pearls of the French gastronomic, notably with the recipe of the soufflée potato.

Confectionery also took off considerably, reaching the industrial stage in the second half of the 19th century.

For the popular masses, cereals and especially bread, are still the basis of meals in the 19th century. The bread is sacred, the soup is eaten at every meal of the day, except for the snack, the potato is a savior vegetable, the wine a very sought-after drink, the meat of butcher's shop a luxury almost inaccessible, the cake the only and true dessert.

The invention of the charcoal-heated cast iron stove, followed by the introduction of cold in the kitchen to preserve food, profoundly changed culinary practices.

The 19th century saw the birth of the food-processing industry, the first canneries, the appearance of sugar beet, the first industrial dairies, the invention of margarine, and the development of national brands in both industry and distribution, heralding new industrial habits that would develop in the 20th century.

The 20th century

The 20th century began under the golden age of gastronomy, when Paris was the creative centre of cuisine. Under the fire of the Universal Exhibition, great innovations and the first automobiles, the first half of this century was marked, in spite of the two wars, by the

link between tourism and gastronomy. Little by little, a real hotel industry was set up. In doing so, the French table manners and taste becomes the international model.

It is in the heart of France that we are now looking for and discovering the gastronomic treasures so far somewhat ignored. The first Michelin guide was published in 1900. From then on, regional kitchens changed their status. Great chefs are inspired by traditional recipes and bring traditional products into French gastronomy.

Geography and the natural agricultural landscape

France is the result of a long history that lead to her sovereignty inside borders patiently acquired and the emergence of the concept of nationhood. This territory was constructed over various landscapes (Cheize, 1996).

With 551,695 km² acquired over a thousand-year construction, metropolitan France is the 47th largest country in the World (it is the largest country in Europe). Its density is 115 inhabitants by square kilometer, one of the weakest in Europe. Often represented as a hexagon, France has borders with six other countries. It seats at a geographical, climatic and agricultural crossroads between North and South of Europe. On the West and South parts, France benefits of a maritime and oceanic opening on the Mediterranean Sea, the Atlantic Ocean and the Channel. These façades promote its economical and commercial relationships with other continents. On the East and North sides, France opens on the European continent across different channels such as the Rhine, the Alps and the Ardennes plain and plateau. As a whole, France is a lowland country where the plain, low-plateau and mid-mountain regions prevail over the high mountainous territories (Cheize, 1996).

France has a privileged climatic situation explained by mean latitude (42°5 N/51°N) and a double maritime front. Moreover, the layout of the relief on the eastern and southern borders of the country favors a wide opening to oceanic influences and the weather instability linked to the passage of the Polar Front. This explains the succession of different types of weather on the Hexagon. July temperatures rise from south to north in a latitudinal pattern, and January temperatures decrease from west to east in a meridian pattern. The French climate is essentially temperate but can be parted in three major climatic domains. The oceanic domain along the Atlantic coast is characterized by mild climate in winter, cool in summer and humid all year round. The East is subjected to a continental and mountainous degradations (cold winters, hot summers and storms) while the sweet and pleasant Mediterranean amphitheater is characterized by warm, dry summers and mild winters. This French specificity is a particularly favorable climate for agricultural activities. France is a very ancient agricultural power and it is considered as the bread basket of Europe. Its great plains allow the production-oriented cereal agriculture, and the development of market gardening and renowned viticulture.

Traditional agricultural and food products are an expression of culture, and way of life resulting from local climatic, agricultural and economic conditions that determine

production and processing practices. Over time, rural areas offer a variety of traditional regional agricultural and food products that reflect human interaction with the environment. Tradition implies the presence of knowledge or attributes handed down from generation to generation. Traditional agricultural and food products have characteristics that distinguish them from other similar and generic products, whether at the level of composition (specific raw materials and primary products—animal species or plant variety—and their combination) or production and processing methods. For processed food products, these methods can give rise to specific culinary traditions (Boto et al., 2013).

French agriculture is in a restructuring phase: the number of farms is falling and agricultural activity is concentrated on increasingly larger farms. In 2010, there was 516,000 French farms representing 16% of the agricultural soil in European Union, whereas only 450,000 farms remain in 2016. France is the first agricultural producer in Europe with 18% of the total production representing 71 billion Euros in 2016 (Anon, 2015) (Table 1).

Covering more than 282,000 km² (28 million hectares), or 51% of the total surface area, agricultural landscapes outnumber the so-called natural soils (forests, moors, wastelands, guarrigues...). The cultivable land allows a great diversity of production.

The most agricultural regions are located in western and northern France (Haut-de-France, Normandie, Bretagne, Champagne-Ardenne, Ile-de-France, Auvergne, and Bourgogne) where an average of 70% of the surface of the territory is cultivated. On the contrary, to the South of a diagonal line linking the Gironde estuary to the Vosges, so-called natural soils occupy a part of the territory above the national average (e.g., 84% in Corsica and 44% in Alsace) (Anon, 2014).

The quality vineyards in France represent one of the major elements of French agriculture and tradition. These large vineyards are very varied: Bourgogne, Bordelais,

Table 1 France's share and rank in EU-28 agricultural production in 2014 (Anon, 2017a)

Product	Share in EU-28 total production	Rank in EU-28
Wheat and spelt	24%	1st
Corn (grains)	21%	1st
Oilseeds	21%	1st
Fruits	13%	3rd
Vegetables	10%	3rd
Wines	55%	1st
Beef	25%	1st
Pork	9%	3rd
Sheep and goat	15%	2nd
Chicken	16%	1st
Milk	16%	2nd

Pays-de-la-Loire, Champagne, Alsace, Cognac, each with its own original features and are gradually being integrated into the luxury food industry complex. Wine is one of the most exported French productions.

Wheat is the most cultivated cereal ahead of corn and barley. In metropolitan France, the main production areas of cereals, oilseed and protein are located in region Ile de France, Centre, Poitou-Charente, Champagne-Ardenne and Midi-Pyrénées (13 million hectares). The area under forage crops (15 million hectares), intended for animal feed, is 90% grassland (Anon, 2014).

With its industrial beetroot (Northern and Eastern France) and cane crops (Antilles), France is the leading sugar producer in Europe.

French potato production is mainly located in the northern part of France (Hauts-de-France, Bretagne, Normandie, Grand Est and Centre).

Production of fresh vegetables amounts to 5.5 million tons in 2016 (tomato, carrot, sweet corn, salad, green bean, onion, cauliflower, melon, cabbage, peas...). This production is scattered in the whole country.

Fruits are mainly produced in the south and the west of France with a total of 2.5 million tons in 2016. Apple production is in first place, with 60% of the fruit volume. Moreover, the French production of fruit is also composed of plum (8.5%), peach (8%), pear (5%), apricot (4.5%), kiwi (2.5%), strawberry (2.3%), table grapes (2%), walnuts (1.5%) and cherry (1.5%) (Anon, 2017a).

Livestock breeding occupies an important place in France, which is explained by the diversity of climatic conditions, soil properties and regional specializations and traditions. The grasslands used for livestock can be found in Bretagne, Basse-Normandie and Pays de la Loire where dairy cows and pigs breeding are currently developed. Oceanic climate allows rapid and continuous grass regrowth. Nearer of the Mediterranean Sea where more rocky ground are found, goats, sheep and cattle are reared for meat (Cheize, 1996). Livestock farming is one of the pillars of the agri-food industry, at the origin of famous products and French traditions (e.g., cheese).

France has a large fishing potential thanks to its marine facades. Production of fishery products comes from two essential sectors of different importance: maritime fisheries (about 525,000 tons in northern and central Atlantic, Channel, and North Sea) and aquaculture (production activity of 180,000 tons in river, pond or seaside). Shellfish farming (oyster and mussel) represents a traditional activity developed on the coast of the Atlantic Ocean (Anon, 2017a).

Culture and traditions

The French food model

The French meal usually consists of an appetizer, main course, salad, cheese and dessert. This ordering of the dishes has a long history, and evolved over the centuries. From the

Middle Ages to the Renaissance, the great meals of the period are structured in several services composed of a set of dishes arranged at the same time. The plates are laid in advance, removed all together and replaced by another series, each series constituting a service. Guests use what is within arm's reach. This way of serving, already common in the Middle Ages, was called “à la française”, as opposed to the service of individual portions introduced in the 19th century and called “à la russe”.

Today, our food model is distinguished by its high level of sophistication in comparison with other culinary traditions. Today, the strong trends of this French model are grouped around six central points (Mathe et al., 2009).

- Three main meals a day, taken in groups and around a table, at relatively fixed times and common to all;
- A relatively high preparation time and duration of meals (more than in other European countries);
- A meal structured by at least 3 components in order;
- Great importance given to the taste of food;
- An important dietary diversity;
- An intervention of know-how transmitted by experience.

Traditional celebration

Many culinary rituals are inscribed in our culture, often related to religious celebrations. They take place throughout the year, for example in January, the 6th; Epiphany is celebrated by eating a Kings cake. Several kinds of cake are available, either they are made of puff pastry filled with frangipane (mixture of almond powder and butter) or they are brioche topped with candied fruits. Inside is a bean that will designate the king or queen.

Then comes “la chandeleur”, or candlelight festival, which is celebrated every year 40 days after Christmas, on February 2. During this day, the tradition is to eat pancakes. At the end of February or at the beginning of March, there is the tradition of Mardi Gras. Mardi Gras is the day before Lent (40 days of fasting and prayer), Christians could eat “fat”, hence its name. The tradition of making pancakes and donuts comes from the need to exhaust all the supplies of eggs and fats that could not be preserved during the 40 days of Lent. The word Carnival comes from the Latin “carnelevare”, which means “to remove meat” and corresponds to the interdiction of eating meat during Lent. Today, this religious custom is much less respected, but the tradition of Mardi Gras still persists with the making of carnival donuts.

During Easter, the Easter egg is the most widely distributed gift; eggs are brought by Easter bells or rabbit in Alsace. In France, Pascal lamb is a culinary tradition respected by many families. Most people are used to prepare a leg of lamb served with potatoes, green beans or flageolets. In Alsace and parts of Germany, a lamb-shaped biscuit is also made. In the Drôme, we prepare the « couve crestoise », a kind of dry cake. Dating from the early

18th century, this “shortbread” is a cake traditionally served for Easter. The « couve » gets its name from its shape: a nest of hens with their eggs. It is a thick cake of about 2 cm, without any yeast, where balls of dough have been added: in the center to simulate the chicken and all around to reproduce the eggs.

Then at the end of the year comes Christmas allowing families to gather around a hearty meal. The foie gras, oysters, snails, smoked salmon, game and stuffed poultry are often on the Christmas meal menu. For dessert, a Christmas log is usually served. Depending on the region, several rituals exist during the holiday season. In the south of France, in Provence, 13 desserts personalizing the 12 apostles and Jesus are served. You will find the traditional olive oil bread flavored with citrus zest called “pompe à l’huile”, local sweets and pastries (such as the famous calissons of Aix), black and white nougat, candied fruits, fresh and dry (grape, almonds, figs, hazelnuts). In eastern France, there are “Mannala” means “little guy” in Alsatian. It is a variety of brioches shaped as little men served in Alsace for St. Nicolas since the fifteenth century. They represent the patron saint of schoolchildren or the three children he saved from the butcher, according to the legend. They are always served with hot chocolate. Sometimes raisins or chocolate chips are added to it. We find a similar tradition in the north of France, where we eat at the time of St. Nicholas and Christmas, a brioche representing the little Jesus swaddled, it named “the shell”.

In Alsace, one of the traditions at the time of Christmas is the cooking of Christmas cakes, “les bredeles”, there are a multitude of them which vary in their shapes and flavors: chocolate, cinnamon, anise, jam, citrus peel with butter in the form of stars, fir or animals.

In Aquitaine, there are the “guinettes”, cherries with brandy covered with chocolate.

In the South-West, called the land of prunes, this fruit is honored on the Christmas table. In the past, grills were used to preserve prunes in the oven. Presently, at the end of the dinner, prunes are placed in the middle of the table, prunes filled with almond paste, chocolate prunes and other delicacies made with prunes or other dried fruits.

Typical foods and food products

In France each region has its own traditional recipes. There are a very large number of them. In order to guarantee quality, to fight fraud and to promote traditional products, there are several quality labels, including Protected Designation of Origin (PDO), the Appellation d’Origine Contrôlée (AOC, national level), the Traditional Speciality Guaranteed (TSG) and the Protected Geographical Indications (PGI), which guarantee a link between the product and its terroir. **Protected Designation of Origin (PDO)** stands for a product for which the principal steps for production are done following a well-established technique within the same geographical area, which gives the product its characteristics. It is a European symbol that protects the name of the product all over the European Union.

The Appellation d'Origine Contrôlée (AOC) refers to products meeting the criteria of the PDO and protects the denomination on the French territory. It can also relate to products not covered by European regulations (e.g., forest products case). It is the notion of soil (terroir) that is the basis of the concept of Appellations d'origine—AO. A terroir is a specific geographical area where production takes its originality directly from the specific nature of its production area.

In 2015, there were 366 wines, ciders and eaux-de-vie with the PDO/AOC label; 50 AOP for dairy products and 44 AOP for agri-food products (Anon, 2016a).

The protected geographical indication (PGI) identifies an agricultural product, raw or processed, which quality, reputation or other characteristics are linked to its geographical origin. The PGI applies to agricultural, agro-food and wine sectors. PGI is related to skill and gives protection not only at national, but also at international level.

In 2015: 126 French agri-food products are registered as PGIs; 74 French wines benefit from this sign, which represents 1/3 of French wine production (Anon, 2016b).

The Traditional Speciality Guaranteed (TSG) refers to a product for which its specific qualities are related to a composition, methods of manufacturing or processing based on a tradition.

In 2015, only one product (moule du Bouchot), are registred as TSG (Anon, 2016c).

Meat

Figures of French production

France has 18.7 million head of cattle in 2011. The most widespread breeds of cattle are Charolais, Blonde d'Aquitaine and Limousine; they are destined for meat production, 35% of which live in central France. France has 3.7 million dairy cows.

For sheep, France has 7.6 million sheep heads, including 1.3 million ewes reared for milk production (the 6th largest herd in the European Union).

For pigs, France has 14 million head, including 1.1 million sows. 70% of the French herd is in the far west. With 32.5 kg per inhabitant in 2011, it is the meat consumed the most in France. France is the third largest producer in the European Union.

For poultry, France has 142 million animals. Brittany is the first region for chicken, laying hens and turkeys. Pays de la Loire is the 1st region for roasted ducks and guinea fowl. Aquitaine is the first region for forced-feeding ducks.

For goats, France has 1.4 million head, of which 940,000 goats dedicated to produce milk. With 31% of the herd and 70% of industrial goat cheese, Poitou-Charente is the leading region for goat milk (Anon, 2012).

Some of these products have quality sign like PDO, AOC or PGI certified. For beef and veal there are 15 of them owning these label of quality, we can cite the beef of Charolles, the bull of Camargue or the calf of Limousin; for sheep, there are 14 meats, among which the Prés salé of the bay of Somme or lamb of Aveyron; For poultry we can cite the turkey of Bresse or duck used to produce foie gras from the south-west and for pigs there

are 5 pork meats and 43 deli meats under sign of quality such as the Coppa de Corse, the rillette de Tours or the sausage of Morteau (Anon, 2016d).

Benefits and adverse properties

Meat is a protein-rich food. Animal proteins are relatively high in essential amino acids and generally higher than plant proteins. In general, animal proteins are slightly more digestible than plant proteins. Foods of animal origin are characterized by a greater level of proteins that are high in nutritional value (as measured by composition of essential amino acids, digestibility, etc.).

Regarding meat consumption, it is recommended by French Agency for Food, Environmental and Occupational Health & Safety (ANSES), not to exceed 25 g per day of deli meats. Consumption of processed meat (deli meats, dried beef, canned meat and preparations for sauces) was classified as “carcinogenic to humans” by the International Agency for Research on Cancer (Circ) in 2015. For red meat it is recommended to eat a maximum of 500 g per week. It has been classified as ‘probable carcinogen’ for men, mainly for colorectal cancer and, to a lesser extent, pancreatic and prostate cancer. It is also recommended to limit the consumption of cooked meat at high temperature (barbecue, frying...) because it promotes the formation of carcinogenic chemicals (such as polycyclic aromatic hydrocarbons and heterocyclic aromatic amines) and to vary the cooking methods (boiled, roasted...) (Anon, 2016e).

Traditional recipes

Many traditional French dishes are made up of meats such as beef, veal, pork, rabbit, poultry or less common animals such as frogs and snails. For beef-based dishes we can mention Burgundy beef. This dish is prepared by braising the beef in a full-bodied, classic red Burgundy wine. It is then stewed with potatoes, carrots, onions, garlic, and well-seasoned with a *bouquet garni*. Traditional preparation of this dish is two days, to continually tenderize the meat and to intensify the flavors of the stew.

Another traditional dish is “le coq au vin”, chicken braised with wine, lardons, mushrooms, and optionally garlic. A red Burgundy wine is typically used, though many regions of France make variants using local varieties, such as *coq au vin jaune* (Jura), *coq au Riesling* (Alsace), *coq au pourpre* or *coq au violet* (Beaujolais nouveau), *coq au Champagne*. Like the “coq au vin”, the traditional boiled chicken was instituted as the French national dish by King Henry IV: «I want every ploughman in my kingdom have boiled chicken on Sundays».

Another dish usually eaten during the Christmas and New Year is foie gras. It can be eaten raw, semi-cooked or cooked, and can be offered as a fresh or canned product, consumed alone on toast or gingerbread served with fruit jam (fugue or onion confit) or with other dishes such as meat. According to French law, “foie gras is part of the cultural and

gastronomic heritage protected in France. Foie gras is usually served with a sweet white wine such as Sauterne, Monbazillac or late harvest wine.

Another speciality generally served during the holiday season is Burgundy snails, presented in their shells, with garlic butter and chopped parsley, they are baked and served by dozens or half dozen, usually on a specific plate. Wild game is also present on French tables during Christmas holidays, wild boar, roe deer, deer... these meats are generally marinated to make them more tender and prepared in sauces.

Another of the French specialities is frog's legs, now served in butter with garlic, once served in soup. The Tête de veau is also a typical dish of which one of our previous presidents, Jacques Chirac, greatly appreciated accompanied by a beer. There are several ways to prepare a veal head, in the *Grand Dictionnaire de la Cuisine*, Alexandre Dumas describes nine different recipes. The calf's head can be served in its natural state, accompanied by flavored vinaigrette. Most often, in France, it is served with a gribiche sauce or a ravigote sauce.

Fish

Figures of French production

France has a coastline that allows it to fish for fish and seafood. In 2015, 730 million tonnes of seafood products were sold, 39 million from fish farming, 205 million from shellfish farming and 486 million from fresh fishing. The main species sold are oysters, tuna and mussels. Four seafood products benefit from a protected designation of origin or geographical indication: anchovies from Collioure, scallops from the Côtes-d' Armor, oysters from Marennes d' Oléron and Moule de Bouchot from the Bay of Mont-Saint-Michel (Anon, 2018a).

Benefits and adverse properties

Fish is an excellent source of protein, just as much as red meat. It also has fat in varying quantities depending on the species, which are sources of omega-3 fatty acids “omega-3s”. Among oily fish, some contain more long chain omega-3 s and are therefore particularly interesting for nutrition. The omega-3 s called “long chain” (EPA or eicosapentaenoic acid and DHA or docosahexaenoic acid) are the ones that prevent cardiovascular disease and are necessary for the development and functioning of the retina, the brain and the nervous system. Salmon, sardine, mackerel and herring have a high content of omega-3 (3 g/ 100 g). Fish also provide minerals such as phosphorus and trace elements such as iodine, zinc, copper, selenium and fluorine, but also vitamins A, D, E and some of the B group, all of which are essential for health.

However, fish may also be contaminated by environmental pollutants such as dioxins, polychlorobiphenyls (PCBs) and methylmercury, environmental contaminants that may have adverse effects on health in the event of overexposure. PCBs and dioxins are found

primarily in the oiliest fish (eel) as well as in some fish that tend to bioaccumulate toxins (barbel, bream, carp, catfish), while methylmercury is found in wild predatory fish.

To ensure all the benefits from eating fish and meet people's needs for long chain omega-3 s while minimizing the risk of overexposure to contaminants, ANSES recommends eating fish twice a week, including one portion of fish high in omega-3 s, and one lean fish.

Consumers should also vary both the species of fish and its source, and limit their consumption of PCB bioaccumulating fish to two portions per month for the general population (Anon, 2010a).

Traditional recipes

Traditional French dishes based on fish or seafood are mainly found in coastal regions. Seafood platters made up of lobsters, crayfish, oysters, mussels... One of the most popular recipes is "moules marinières" which is mussels cooked with white wine, shallots, parsley and butter. Another dish made from mussels, the "mouclade Charentaise" is prepared with mussels of bouchot, shallots, Charentes butter, egg yolks, pineau des Charentes or cognac, garlic, a bouquet garni and fresh cream, curry and saffron are also added according to recipes.

There is another way of preparing the mussels named "éclade". In this preparation the mussels are placed vertically and spirally on a wooden plank and then covered with pine needles, which are fired until the mussels have been cooked. We traditionally eat the "éclade" with bread and Charente butter, accompanied by white wine from the Charentais region.

There are also la "Bourride" which is a soup made with fish and seafood thickened with aioli and served with garlic crunchy bread. "La Tielle" is a round pie made from bread dough with fluted edges and a garnish made of octopus, mixed with a spicy tomato sauce. And the most famous dish "la bouillabaisse" a traditional recipe from the South of France, consists of a fish soup that is eaten with croutons of breads often garlic and spread with sauce rusts, fish served whole, and potatoes. Another typical recipe from Bordeaux is the lamprey, small fish, consumed in the Middle Ages as pie crust, lamprey is the only fish to be bled alive during its preparation. His blood is then mixed with red wine to form the black sauce. This typical seasoning enhances a garnish of leeks, onions and herbs.

Vegetables and Fruits

Figures of French production

In 2016, 5.6 million tonnes of fresh vegetable were produced, the two main crops were tomatoes and carrots which account for almost 25% of total crops. For fruits, 2.8 million tonnes were produced in 2016 with the main crops by far were apples followed by peaches and nectarines (Anon, 2018b). French vegetables and fruits production benefits from official quality label (see Table 2).

Table 2 List of French vegetables and fruits owing a quality label

	AOC and PDO		PGI		
Vegetables	Béa du Roussillon (potatoes) Pomme de terre de l'Île de Ré (potatoes) Lentilles vertes du Puy (green lentil) Oignon Roscoff (onion) Oignon doux des Cévennes (onion) Coco de Paimpol (beans) Piment d'Espelette (pepper)		Ail blanc de Lomagne (white garlic) Ail de la Drôme (garlic) Ail rose de Lautrec (pink garlic) Asperges des sables des Landes (asparagus) Asperges du Blayais (asparagus) Haricot tarbais (beans)		Mâche nantaise (lamb's lettuce) Mogette de Vendée (white beans) Poireaux de Créance (leek) Pomme de terre de Merville (potatoes) Lingot du Nord (white beans) Lentilles vertes du Berry (Green lentil)
Fruits	Chasselas de Moissac (Grapes) Châtaigne d'Ardèche (chestnut) Noix de Grenoble (nuts) Noix du Périgord (nuts)	Abricot rouge du Roussillon (apricot) Pomme du Limousin (apple) Muscat du Ventoux (grapes) Figue de Solliès (fig)	Melon de la Guadeloupe Melon du Haut Poitou Melon du Quercy Mirabelles de Lorraine Fraise de Nîmes (strawberry) Clémentine de Corse	Pommes des Alpes de Haute Durance (apple) Pommes et poires de Savoie (apple) Pruneau d'Agen (prune) Kiwi de l'Adour (kiwi fruit) Fraise du Périgord (strawberry)	

Benefits and adverse properties

A public health recommendation in France is “eat 5 fruits and vegetables per day” in order to prevent against the cardiovascular disease, cancer, and premature mortality. In fact, vegetables and fruits contain vitamins, minerals, a lot of antioxidant compounds and fiber to prevent overweight and other diseases. The higher consumption, the greater benefit. For example, with 10 daily doses of fruits and vegetables, 7.8 million premature deaths worldwide could be prevented, according to a recent meta-analysis (Aune et al., 2017). The risk of stroke decreases by 33%, cardiovascular disease by 28% and cancer by 13%. Apples, pears, citrus fruits, salads, green and yellow vegetables, brassica (cabbage...)

are the most protective. In practice, one portion is about 80 to 100 g. Lentils, chickpeas, dried beans and beans are as rich in protein as meat or fish. It is recommended to eat at least 30 g per day. They provide complex carbohydrates, fiber that facilitates intestinal transit, B vitamins and minerals: 100 g provides 30 to 50 mg magnesium, 2 to 3 mg iron and 1 g potassium. A study of 130,000 people over 32 years suggests that a 3% increase in plant protein intake reduces the risk of death by 10% and cardiovascular disease by 12% (Song et al., 2016).

One of the adverse effects for fruits and vegetables is the presence of pesticides residues that they could contain. But recent controls made by European Food Safety Authority (EFSA) (2015) showed that 97% of collected foods are under the maximum residue limits (MRL): only 2.6% of fruits and 3.5% of vegetables analyzed were above the MRL. But finding residues doesn't mean that the products are toxic for human. The MRLs are set so as to remain well below toxicological thresholds, i.e., in such a way that the quantities of residues that an individual is likely to find daily in his diet are under no circumstances toxic, in the short or long term. For fruits or vegetables, the MRL is set for products that are neither washed nor peeled. Therefore, ANSES recommends peeling or washing these products before consumption.

Traditional recipes

One of the traditional dishes in the East of France is the “Choucroute garnie” made with sauerkraut combined with sausages and other salted meats, potatoes or fishes. Usually, this recipe is served with a glass of white wine. An other dish from the South of France is “ratatouille”, a stewed vegetable dish with tomatoes garlic, onions, zucchini, eggplant, bell peppers, marjoram, fennel and basil, or bay leaf and thyme, or a mix of green herbs like herbes de Provence. One of the traditional French dishes made from potatoes is “Gratin dauphinois”: which is raw potatoes, thinly sliced, and milk, cooked in a buttered dish rubbed with garlic. Also, “Cassoulet” dish originated from the South are made with white beans with duck or goose confit and sausages.

Among the French culinary specialities based on fruits we can quote the fruit pie, strawberry pie, mirabelle plum, apple pie. One of the most famous pies is the “tarte tatin” which is an apple pie caramelized with sugar and butter, the dough arranged above the filling. After baking, it is spilled on a plate and served warm with a little fresh or whipped cream. Another speciality from the West of France is “Far Breton”, made with eggs, sugar, flour, milk and prunes. A similar traditional cake is made but with cherries named “clafoutis”.

Grains

Figures of French production

France produces an average of 70 million tonnes of cereals per year (25% of the European Union's production). It is the 4th largest wheat producer in the world, covering nearly 9

million hectares. French farmers cultivate about ten species, but the most important are: common wheat, corn, barley, and durum wheat (Anon, 2017b).

France also produces rice, 100,000 tons of paddy rice on 20,000 ha cultivated in Camargue which has a PGI appellation. « Le petit épeautre de Haute Provence », nicknamed “the caviar of cereals”, has also a PGI appellation as well as « blé Nord de Bretagne ».

Benefits and adverse properties

Cereals are one of the essential foods for our body, they provide energy and fiber. They are rich in carbohydrates and fiber; phosphorus and magnesium; contain B group vitamins and are low in fat. It is recommended to eat complete or semi-complete cereals in order to keep their nutritional qualities.

It has been shown that consumption of whole grain products reduces the risk of type 2, cardiovascular disease and colorectal cancer. The risk of type 2 diabetes is reduced by 25% for the highest intakes, and reduces the risk of colorectal cancer by 20% for each additional 90 g/day (Anon, 2016e).

But in some cereals, there is presence of gluten, a set of proteins found in the grains of many cereals such as wheat, rye or barley. Some people have gluten-related disorders name coeliac disease which is one of the most frequent digestive diseases nowadays. The only known treatment remains the total elimination of gluten from the diet.

Traditional recipes

One of the symbols of the France is the “baguette de pain”, bread of elongated shape, it is made from flour, water, yeast and salt. Several steps are necessary to obtain the baguette: there is kneading (the ingredients are mixed in a mixer) to obtain a big ball of dough. Then there is the pointing where the dough rests and begins to swell, thanks to the yeast it contains. Then the division, where the dough is divided into small balls of the same weight: the dough pieces. Each dough is then shaped into the desired shape. Then comes another pause, the raw baguettes are placed on a tissue so that they swell again. And finally the baguettes are baked in an oven at 250 °C. The baguettes obtained have a very crunchy and golden crust, while the inside, the crumb, is white and soft. The baguette is usually eaten at the breakfast with butter and jam but also during mealtime.

Others symbol of the French is the « croissant », eaten at breakfast, this viennoiserie is made from puff pastry and has the shape of a crescent moon. Like the « baguette » several steps are necessary to make a good « croissant », the quality of the flour and butter used, the fermentation time of the dough, how to incorporate the butter, how to shape the croissant, the heat of the oven, the cooking time....all these parameters are important in the making of the croissant.

Pancakes are also a traditionnal recipe, it could be eaten as a main dish or for dessert. The pancakes are made with flour, eggs, milk and sugar. Sometimes flavors such as

vanilla, orange blossom, rum, beer or cider alcohol are added when eaten in desserts and can also be flambé with strong alcohol such as Grand Marnier or rum. Wheat flour is usually used for pancakes eaten as dessert and buckwheat flour for salted pancakes. Sweet crepes are usually topped with jam, melted chocolate or sugar, salted crepes can be topped with all kinds of ingredients like ham, eggs, salads, cheese or even seafood. In western France, they are usually served with cider.

Beverage

Figures of French production

Among the drinks traditionally produced and consumed in France there are wines (white, red, rosé) spirits and sparkling wines. In 2016, France produced 45,562,133 hectolitres of wine and is one of the top three wine producing countries next to Italy and Spain. In France there are 368 wines and eaux-de-vie with the AOC/PDO appellation and 74 wines with the PGI designation, including 2 ciders (Anon, 2017c).

Another drink consumed in France and which allows the production of butter and cheese, is milk. In 2015, 24.6 billion liters of milk (cow, sheep and goat) were collected and used to manufacture: 70% of consumer dairy products (liquid milk, yoghurts, dairy desserts, cheese, butter, cream); and 30% of intermediate products, used in the food, pharmaceutical and chemical sectors (whey, milk powder, casein). In 2016, France had 45 cheeses, 3 butters and 2 creams with the AOC/PDO designation and 7 cheeses and 1 cream with the PGI designation (Anon, 2017d).

Benefits and adverse properties

In France, there is what is called the “French paradox”, in fact in most countries, a high consumption of saturated fats is associated with a high mortality linked to cardiovascular diseases. However, the situation in France is paradoxical: there is a high consumption of saturated fats but mortality from cardiovascular diseases is low. This paradox can be attributed to wine consumption and more particularly to the presence of polyphenols in wine. Indeed, among all polyphenols present in wine there is one molecule, resveratrol, which has shown promising properties in the prevention and treatment of many chronic diseases including cardiovascular, pulmonary, neurodegenerative diseases, diabetes, obesity, AMD, osteoarthritis, cancers and even on the aging process (Bhullar and Hubbard, 2015). But given the presence of alcohol in wine and the potential risks of this molecule, classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC), recommendations concerning the consumption of red wine have to be cautious. Indeed according to the National Cancer Institute, any regular consumption of alcohol, even low, is a risk. Alcohol increases the risk of developing certain cancers such as cancers of the mouth, larynx and pharynx, esophageal cancer, colorectal cancer, breast cancer and liver cancer.

Milk and its derivatives (fermented milks, yoghurts, cheeses...) have many nutritional qualities. In fact, they are main sources of calcium, essential nutrient in the constitution of the skeleton and the teeth; rich in proteins, containing all the essential amino acids, lipids, vitamins (B1, B2 et A...) and lactose. According to an ANSES report (Anon, 2016e), total consumption of dairy products reduces the risk of type 2 diabetes by 5–10% for each consumption of 400 g/day of products and this appears to be more evident for yoghurts, cheese and low-fat products. It also seems that the consumption of dairy products will reduce the risk of cardiovascular disease (10–20% for the largest consumers) but this remains to be confirmed. However, some data suggest that dairy consumption is associated with an increased risk of prostate cancer (7% for each 400 g/day increase in dairy products and 9% for each 50 g/day increase in cheese).

Traditional recipe

France is known for its wines and cheeses. Wine production as well as cheese making is done everywhere in France. There are a multitude of products but each region has its specificities. In the west of France, the speciality is cider, a sparkling wine obtained after fermentation of apple juice. It is generally consumed with pancakes. There is also the calvados, a spirit, obtained by distillation of the cider, and consumed at the end of meal as “digestive”. A well-known liqueur produced in France is cointreau, a spirit made from sweet and bitter orange peel. We can also mention guignolet, made from sour and black cherries; cognac, a strong alcohol obtained by double distillation of specific white wines from the Poitou-Charentes region, is aged in oak barrels for at least 30 months; and Armagnac brandy, like cognac, is obtained by double distillation of white wines from the South West region. This region also produces excellent cheese such as Roquefort (raw sheep’s milk), Laguiole and Cantal (raw cow’s milk).

Corsica also offers a great variety of wine and liqueurs such as Cap Corse, a sweet quinquina wine, with decoctions of aromatic plants and macerated oranges; Cédratine, a liqueur produced from a mixture of citrus fruits and Mediterranean aromatic plants; and myrtle liqueur, obtained by alcoholic maceration of myrtle berries or a mixture of berries and leaves rappu, it is a sweet Corsican wine made from partially fermented grape must whose grapes have been raisined, i.e., the grapes harvested are spread out in the sun to enrich the grape with sugar. Among the cheeses produced in Corsica there is Brocciu, made from lactoserum. Another typical drink from the South of France and drunk as an aperitif is Pastis, an alcoholic drink perfumed with aniseed and licorice.

In the Alps region there is the “chartreuse”, a naturally green liqueur made from 130 herbs and other plants macerated in alcohol and steeped for about 8 h. The exact recipes of Chartreuse remain trade secrets and are known at any given time only by the two monks who prepare the herbal mixture. This region also produces cheeses like abundance, reblonchon, tomme and vacherin des Bauges. During the winter one of the specialties consumed is raclette, a dish made from the melted cheese, scraped as it melts, and

traditionally served with potatoes and charcuterie or Savoyard fondue, a mixture of cheeses (comté, beaufort, gruyère de Savoie) melted in a catelon in which pieces of bread are dipped.

The most famous sparkling wine is produced in the Grand Est region of France, champagne, usually drunk for special occasions, as an aperitif or with the dessert. Alsace also produces a lot of wine, one can quote the Gewürztraminer, a very sweet wine, tasted as an aperitif or Riesling perfect to accompany sauerkraut. It is in the Dijon region that the yellow wine is produced, which has the particularity of being bottled in a bottle called the cavelin (a 62 cL specific form bottle).

Food preservation, shelflife and environment

Food preservation is a process as old as human civilization. Food, by its nature begins to spoil from the moment it is harvested. Food preservation is crucial when speaking of food hygiene and health: each single preservation treatment is mainly designed with the aim of delaying the inevitable alteration of quickly perishable foods between production and consumption and so to increase shelflife. Food preservation is an action or method, designed to maintain foods at a desired level of quality (Prokopov and Tanchev, 2007).

Among the most primitive forms of food preservation that are still in use today are such methods as smoking, drying, salting, freezing, and fermenting. (historical origins of food preservation).

Nicholas François Appert, a French confectioner, could be considered the father of modern food preservation. In 1795, Napoleon and the French government offered a reward to anyone who could devise an improved method for practical food preservation. In 1806, he was given 12,000 francs as a reward for his preservation process containing only four steps: 1. Putting the item in containers for processing; 2. Corking or sealing the container; 3. Processing the filled containers in a hot water bath, with the processing time being determined by the contents. 4. Removing the processed containers from the hot water bath and cooling. This method is basically the low sterilization procedure of canning method used today (Micali et al., 2016).

The following traditional methods are used in France to preserve food from pathogen agents and stop the oxidation:

- application of heat, such as canning and preserving, pasteurization, evaporation, sun-drying, dehydration and smoking,
- application of cold, as ill cold storage, refrigeration and freezing,
- the use of chemical substances such as salt, sugar, vinegar, benzoic and lactic acids,
- fermentation, examples being acetic, lactic, alcoholic, etc.,
- such mechanical means as vacuum, filtration and clarification processes, devices or agents for preventing chemical deterioration or bacteriological spoilage (the use of oil, paraffin and water glass are included here),
- combinations of two or more of the above

Future outlook

French consumers' representations and expectations of the food of tomorrow are characterized by a paradox. There is indeed the coexistence – even among the same individuals – of two attitudes which, at first glance, seem contradictory: on the one hand, the expression of a real interest in innovations in the field of food; on the other, a growing mistrust of new “industrial” foods and technologies in general. In France, studies show resistance to technological innovation (Anon, 2010b). At the same time, consumer behavior shows a desire for reassurance (safety) and confidence (identity) and translates into the return to the roots and tradition, a quest for naturalness and authenticity, a purchase of “old tradition” products.

In order to find authenticity, French consumers buy products that are better identified and certified, raw or less processed. They favor quality and emphasize product traceability, proximity and origin, in particular official quality and origin markings such as the Protected Designation of Origin (PDO), the Protected Geographical Indication (PDI) and the Traditional Specialty Guaranteed (TSG).

By 2025, this tendency will be strengthened due to the French consumers' concern on the origin and the security of the food products. All the food crisis and threats that rose since the beginning of the century (horse meat traceability issue, avian influenza, BSE crisis, baby milk contamination, relationship between diet and illness...) lead the consumers to the quest of healthy, safe, unadulterated, minimal transformed products (Anon, 2017e).

Traditional foods are perceived by the clients as products from family habits, passed on by previous generation or associated to a territory (Pantin-Sohier et al., 2015). Within the very competitive market of traditional food, innovation should not be cut off from traditional products and must be stimulated by the producers and the industries if they want to persist (Pantin-Sohier et al., 2015).

Tradition will live only if the industries evolve a reinterpretation process of the client's demand. New ways of thinking the traditional products will generate new opportunities in terms of nutrition, sensoriality, convenience and use, innovative process, marketing positioning. Traditional producers have several levers available compatible with the tradition such as organic raw materials, product range expansion, reduction of fat/sugar content, safer processes, longer shelf life, intelligent packaging.

Retro is the new sexy

As nostalgic consumption and fondness to nostalgic brands (retro marketing) are proved to be important for 72% of the French consumers, traditional foods have to adapt to new modes of consumption and to target tomorrow's consumer (i.e., young people) (Chardenon, 2015). Consumer's expectations must boost the innovative processes of traditional producers combining modernity and authenticity. A new trend called retro-

innovation is rising in the industries. Producers have to enhance “pleasure” of consumption by developing new traditional recipes or attractive and sophisticated packaging. Proximity is another leverage that is currently fashionable and that will spread in the future. Consumers find more and more interest in regional and local products (“I know where it comes from and what is inside”). Industries are developing territorial brands with strategies and specifications variable from one region to another. 100% French ingredient sourcing is an argument highlighted on the packaging as a sales pitch. It gives the consumers a feeling of familiarity and confidence and reinforces the values of tradition and transparency (Huguenel-Durand, 2018). Agricultural production is also diversifying to attract new target clients with “forgotten” species or varieties.

In order to innovate and ameliorate general cooking including traditional food products, scientists developed molecular cooking also called molecular gastronomy. Their objectives were to explore and understand the physical, chemical and biochemical phenomenon happening during food preparation and consumption. The results of these researches allowed the traditional cuisine to improve and innovate regarding the texture, the aromas, and flavors and to develop new fabrication processes (This, 2015).

Some wanted to provoke a rupture in traditional cuisine, so they decided to shift to note-by-note cooking. This note-by-note cooking was created by Hervé This, a French eccentric physical chemist at the Institut National de la Recherche Agronomique (INRA). After creating the molecular cooking by researching and understanding the food chemistry reactions of the traditional cooking and innovate in using original utensils, new ingredients and modified processes, he considers that “cuisine” is both science and art as it arouses our emotions. This idea led him to reinvent cooking: instead of using traditional ingredients (meat, fish, fruit, vegetables) to make traditional recipes, Hervé This prefers now to cook using chemical compounds (This, 2014). He can thus create food with new forms, colors, flavors, aromas, consistence and nutritional constitution. Some famous chefs already tried this evolutionary note-by-note cooking and served dishes. Julien Binz from a starred restaurant in Alsace proposed a meal 100% note-by-note with a beet/cherry/almond cloudy sorbet for the starter followed by a smoked and rosty chicken vegetal pea protein as a main dish and completed with a cucumber—pine “macaron”.

This view of the future of traditional food and food in general rise many questions about many facets. The agricultural practices will need to adapt not to produce ingredients but valorize the product to obtain cooking molecules like fibers, vitamins, aromas. New researches are needed to evaluate the sensorial effect of the mixing of various chemical compounds. Politics and economics will have to redesign the traditional agriculture known to be unviable for the numerous inhabitants on our planet. Although this innovation is still at dawn, several advantages to this new way of thinking about traditional food are emerging: new tastes, new flavors, less food wasting, less energy consumption, more food for the planet.

Traditional food and innovation are considered by the majority as opposite. Association between these two concepts is very challenging for the food industry. The future traditional food products need to be improved with respect to product quality, to packaging which preserves the sensory quality and improves the shelf life, to health and safety and to marketing (Kühne et al., 2010).

The French food model remains a standard in most homes in the country, but it started to hybridize in contact of innovations, constraints of life rhythms, influences of different social classes and communities, age classes, globalization, etc. Traditional products are still a way of enhancing the French consumers' quest in pleasure, serenity and conviviality (Anon, 2013).

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