Spices and aromatic herbs : what benefits for our health ?

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Used for pleasure, spices and culinary herbs provided by our environment also have amazing nutritional qualities that contribute to human health. Their fragrant and strong-tasting compounds often participate in the defence of the plant that produces them against environmental damage. Ingested in our food, they largely keep their bioactive properties: for example, they have antioxidant properties useful to our health. They reduce the risk of so-called civilizational diseases such as obesity, type 2 diabetes, cardiovascular diseases and, as very recently demonstrated, they promote the growth of the "good" bacteria of our microbiota. In addition, spices reduce the amount of fat, salt and sugar in our cooking thanks to the intensity of their aromas and flavours.

1. Discovering herbs and spices

1.1. Spices and civilization

Figure 1. Peasant weddings. Pieter Brueghel the Younger (1564-1638). [Source: Pieter Breughel the Younger [Public domain]]

The term "**spices**" comes from the Latin "species", from which also comes "grocer", the seller of spices. Originating from faraway countries, a symbol of luxury, or rather "paying in cash", and of refinement, spices have, over the centuries, been the source of struggles and violence to gain a monopoly on their trade. Their history is the history of civilizations [1]. The use of spices is found more than 6,000 years ago in Northern Europe, and then, appreciated for their taste, colour and aroma, or for their power to **preserve food**, in ancient times, in Mesopotamia as in ancient Egypt. The increase in trade with Magna Graecia and the conquests of the Roman Empire then brought spices to Europe (Read Focus - The Spice Route, the first fruits of globalization).

Until the 20th century, the use of spices remained essentially hedonistic (flavour, perfume) in contrast to herbs whose medicinal virtues have been known in Europe since the Middle Ages (Figure 1).

1.2. Herbs, spices, a subject of interest in Public Health

It is only recently that we have had scientific studies that report the potential public health benefits of herbs and spices. This work focuses on three main areas:

the analytical aspect and the identification of **bioactive compounds in spices and herbs**;

the **behavioural aspect with** their role in following the nutritional recommendations of the High Council of Public Health (HCSP) [2]: less salt, fat, sugars, more vegetables and legumes;

the **biological** and **clinical aspect** with studies demonstrating their ability to prevent or alleviate diseases.

1.3. What is a spice or an aromatic herb?

Figure 2. Main aromatic herbs. [Source : AM Roussel]

Spices and herbs are all plant origin [3]. In general, we distinguish between spices *(spices* in English-speaking countries), derived from the non-chlorophyllous parts of plants, and herbs *(grasses*), of which the green parts are used.

Often found in vegetable gardens or market garden stalls, aromatic herbs are used for their aromatic, condiment or medicinal qualities, sometimes combined in aromatic mixtures (Figure 2). Their active ingredients are present in the leaves (parsley, bay leaf sauce, chives, ...) or bulbs (garlic, shallot, onions). In cooking, the bouquet garni is used to flavour a stewed dish. Composed of various herbs, it usually contains bay leaves, thyme and parsley.

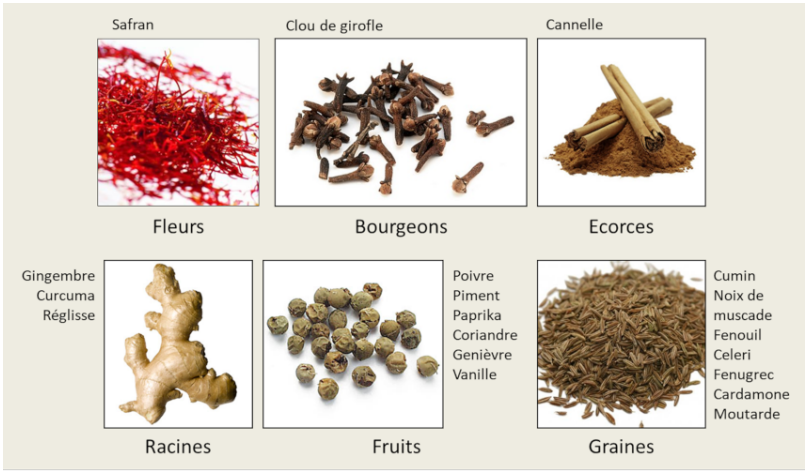

Figure 3. Main plant organs source of spices. [Source : AM Roussel]

Spices are used in small quantities in cooking, mainly to perfume and season dishes, sometimes to give them colour or to help preserve them. In spices, the bioactive compounds may be present in the flower (saffron), bud (clove), bark (cinnamon), root, fruit (pepper, dill, mustard), rhizomes (ginger) or seeds (fennel, coriander, nutmeg) of the plant (Figure 3).

It should be noted that spices stimulate our senses not only thanks to the fragrant or sapid compounds* they contain, but above all, compounds with a trigeminal* action, which distinguishes them from aromatics. They are therefore responsible for odours (orthonasal: through the nostrils; or retronasal: through the retronasal fossae, which connect the mouth to the nose), flavours, and stimulation of the trigeminal nerve (pungent, fresh...). [4]

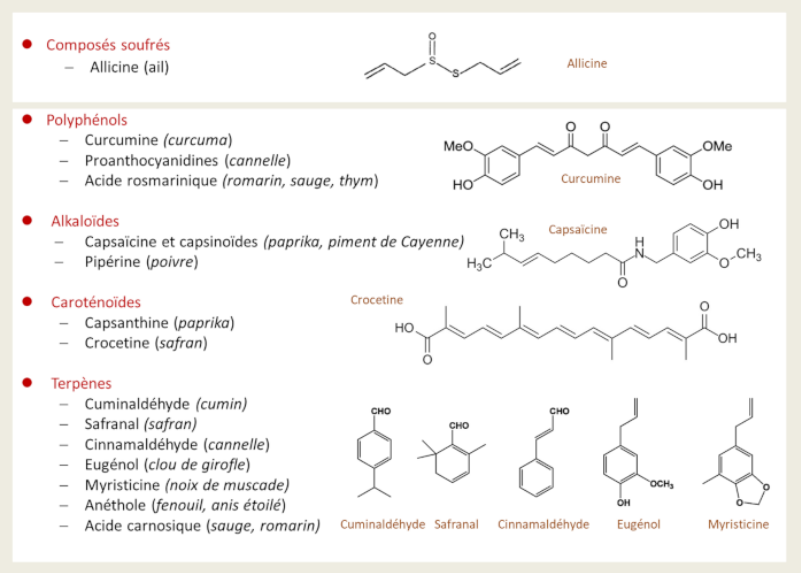

Figure 4. Diversity of bioactive compounds in herbs and spices. [Source: AM Roussel]

Herbs and spices have no nutritional value but are rich in bioactive compounds, polyphenols, alkaloids, terpenes and carotenoids [5], all of which have properties that allow the plant to adapt to its environment (Figure 4).

Their secondary metabolites within the plant, have a protective role against thermal, bacterial or viral stress. For example, the curcuminoids in turmeric powder, of which curcumin is the best known to the public, are first of all protectors of the plant which, when exposed to aggression, change its cellular signalling and induce antioxidant and anti-inflammatory defences. This mechanism is common in the plant kingdom and, by incorporating spices into our food, we benefit from these properties.

1.4. Herbs and spices, sources of dietary antioxidants

Figure 5. Herbs and spices are rich in antioxidants. [Source: AM Roussel]

The **antioxidant power** [6] of herbs and spices is high [7] (Figure 5). As an example, 1 teaspoon of dried oregano is equal, in antioxidant power, to 80g of grapes and a teaspoon of cinnamon to 250ml of pomegranate juice. A mixture of herbs and spices, added to the meat before cooking, prevents the production of fat oxidation derivatives, which are harmful to our cells [8], and the presence of aromatic herbs in the dressing of a salad doubles its antioxidant power [9]. It should be pointed out that, unlike vitamins, the polyphenols present in herbs and spices are resistant to desiccation and heat treatment.

2. Herbs and spices for less salt, less sugar, less fat, more vegetables

Poor food choices increase the risk of nutrition-related diseases such as obesity, type 2 diabetes, high blood pressure, inflammatory diseases, cancers or more recently studied, alterations of the intestinal microbiota (Read Human Microbiota: Allies for our Health) and dysbioses*.

Correcting our food choices is, therefore, a real **Public Health issue**. This goal is difficult to achieve. In spite of the PNNS (National Nutrition and Health Plan) programmes that succeeded one another from 2001 to 2017, and many nutritional information campaigns aimed at the general public, the latest food consumption surveys show that the vast majority of us

continue to eat too few vegetables, to eat too much fat, too much salt and too much sugar.

However, **human** intervention **studies** teach us that **using herbs** and **spices regularly** helps to **correct these dietary errors**.

2.1. Herbs and spices to reduce salt intake

Figure 6. Less salt!

Excess **salt** (Figure 6) is recognized as a major factor in **high blood pressure**, **cardiovascular disease**, and **stomach cancer**. Reducing salt intake has been a key objective of successive National Nutrition and Health Programmes (PNNS). PNNS 3 (2011-2015) has thus set a target of 8 g/d of salt for men and 6.5 g/d for women and children, i.e. a 20% reduction in salt consumption compared to the average consumption of the French population.

Recently published work shows that the use of herbs and spices in a salt-reduced diet is an effective way to reduce salt consumption. When herbs and spices are included in the diet on a daily basis, there is a significant decrease in the amount of salt consumed and a decrease in urinary sodium excretion after 6 months [10]. In another trial, the **perception of salty taste** by the subjects enrolled in the study was **modified by spicy flavours**, allowing them to reduce their salt consumption while maintaining their taste pleasure. Clinically, this benefit is accompanied by a significant decrease in the participants' blood pressure [11]. Finally, a recent English publication reports that the addition of herbs and spices to a soup with 53% less salt increases the acceptance and even palatability of the soup compared to an industrially salted soup [12].

Eating "high in taste" helps ~~a~~ wide audience to reduce salt intake, maintains palatability despite salt reduction~~,~~ and prevents high blood pressure.

2.2. Herbs and spices to eat more vegetables

Figure 7. More vegetables!

Increasing the consumption of fruits and vegetables is a key focus of nutrition recommendations (Figure 7). Consumption is stagnating in France despite repeated information campaigns. Taste is the primary motivation for choosing vegetables, with health or weight control generally being less of a priority. In an intervention trial conducted in overweight subjects who were small vegetable consumers (< 3 servings/d), eating spicy foods and using culinary herbs increased vegetable consumption, with the best results observed in subjects who were usually less fond of vegetables and who had a 91% increase in their consumption [13].

Important for the nutritional education of young subjects, several studies in children [14] and high school students [15], point out that adding herbs and spices to foods **helps to consume unloved vegetables** (celery and squash) and to **get healthy food choices**.

2.3. Herbs and spices to make it easier to eat lower-fat, lower-sweet foods

Figure 8. Less fat! Less sugar!

The epidemic of overweight and obesity is largely due to excessive consumption of fats and sugars, especially soft drinks (Figure 8). Two American studies, conducted in overweight volunteers, show that the palatability for lower-fat and less sweet foods seasoned with herbs and spices is increased, whereas it is decreased when the same food does not contain herbs and spices [16], [17].

3. Herbs and spices, our allies in preventing nutritional diseases

Figure 9. Spices, herbs and prevention of pathologies. [Source: AM Roussel]

In view of the increasing incidence of diseases with a nutritional aspect, the potential biological and clinical benefits of herbs and spices are the subject of very active research [3,4] (Figure 9). Much of this research focuses on the impact of spices and herbs in obesity, cardiovascular disease, inflammatory diseases and dysbiosis.

3.1. Herbs, spices and obesity

Certain spices, used regularly and in nutritional doses, take part in **weight control** through a triple mechanism: increased energy expenditure, increased thermogenesis and activation of ~~fat-burning~~ metabolisms.

The most frequently mentioned spices are cayenne pepper, rich in capsain [18] and ginger, rich in gingerols and shoagols [19]. It must be stressed that it is dangerous to exceed hedonic nutritional doses, i.e. those that provide gustatory pleasure, as excess capsinoids can lead to intestinal and gastric aggression with a burning sensation and an alteration of intestinal permeability leading to dysbiosis.

3. Herbs, Spices and Insulin Resistance: From Metabolic Syndrome to Type 2 Diabetes

Figure 10. Cardamom and Cinnamon. [Source: Left: Didier Descouens [CC BY-SA (https://creativecommons.org/licenses/by-sa/4.0)], right: Simon A. Eugster [CC BY-SA (https://creativecommons.org/licenses/by-sa/3.0)]

The metabolic syndrome, which affects more than one in five French people, is a pre-diabetic condition characterized by abdominal obesity, high blood pressure, too much cholesterol and triglycerides in the blood, high blood sugar and insulin resistance[20]. The metabolic syndrome exposes people to a high risk of type 2 diabetes, cardiovascular disease and early cognitive decline.

It is scientifically established that several spices (cinnamon, turmeric, cumin, cloves, and recently cardamom, Figure 10) and Mediterranean herbs (laurel, tarragon, rosemary) regulate blood glucose, increase insulin sensitivity and improve biological markers of metabolic syndrome [21], [22],[23]. Let us give a special mention to cinnamon powder, of which 1g per day is enough to reduce the blood sugar levels of subjects with metabolic syndrome to physiological values [24].

3.3. Herbs, spices and cardiovascular disease

Figure 11. Cloves. [Source: Creative Commons Attribution-Share Alike 3.0 Unported]

The first cause of mortality in France, cardiovascular diseases often have a nutritional origin (excess of salt, sugars, saturated fats) which is accompanied by hypercholesterolemia, hypertriglyceridemia, oxidized low density lipoproteins (LDL) and therefore atherogenic, hypertension and vascular dysfunction.

In terms of cardiovascular prevention, the most significant results are obtained with garlic in relation to its richness in organo-sulfur compounds [25]. Regular consumption of garlic in powder (600 mg/d) or clove (2.7 g/d) reduces cholesterol levels, decreases platelet aggregation, and has a hypotensive effect [26].

Cardamom, coriander, turmeric, ginger and cloves (Figure 11), consumed regularly, also help to prevent cardiovascular disease because these spices, as described in the previous paragraph, counteract the metabolic syndrome and its vascular consequences through their antioxidant and anti-inflammatory effects.

Moreover, the emerging role of turmeric in protecting the vascular endothelium seems to be due not only to its anti-inflammatory and antioxidant properties but also to the induction of the production of NO, a vasodilator and hypoaggregant [27].

3.4. Turmeric, Ginger and Inflammatory Diseases

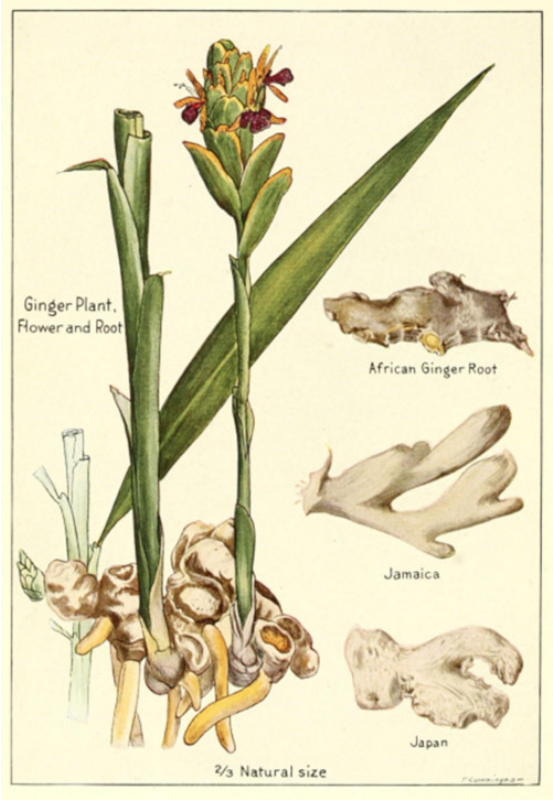

Figure 12. Drawing representing a ginger plant and rhizomes. [Source: McCormick and company [Public domain]]

Turmeric and ginger **block** the activity of pro-inflammatory cellular transcription factors and the production of lipid mediators of inflammation.

Ginger (Figure 12), rich in gingerols and shoagols, used in the form of rhizome powder at 2g/d for 3 weeks, significantly reduces chronic muscle pain [28].

Turmeric (Figure 13) and its active ingredient curcumin are powerful anti-inflammatory drugs that have been recognized for centuries by Ayurvedic Medicine [29]. However, the very poor bioavailability [30] of turmeric powder reduces its effectiveness and high doses, of the order of 10gr/d, are necessary. The properties of curcumin are validated by numerous international studies. Curcumin has been shown to be as effective as non-steroidal anti-inflammatory drugs (NSAIDs) in treating joint inflammation at 500mg/d [31].

Figure 13. Rhizome, slices and turmeric powder. Source: Simon A. Eugster [CC BY-SA (https://creativecommons.org/licenses/by-sa/3.0)]

3.5. Herbs, spices and microbiota: the future

This research area is very promising. Diet is the main factor influencing the composition of the intestinal microbiota and so our health.

Several recent works, *in vitro, in vivo*, show that dietary polyphenols influence the abundance and nature of the intestinal

bacterial flora. Dietary sources of polyphenols (tea, cocoa, fruit) reduce the number of pathogenic bacteria, and increase the number of beneficial bifidobacteria and lactobacilli. In this context, the prebiotic-like effect of a mixture of 7 spices and herbs (oregano, rosemary, turmeric, black pepper, cayenne pepper, cinnamon, ginger) has just been published and opens promising perspectives in the prevention and treatment of dysbiosis and intestinal permeability disorders [32].

4. Herbs, Spices and Health: Benefits and Limitations

Profits. Based on validated scientific studies, it appears that the regular consumption of aromatic herbs and spices brings many benefits to our Health. Aromatic herbs and spices :

increase the nutritional quality of our food by protecting it from oxidation and the formation of carcinogenic compounds

help develop healthy eating habits: less salt, sugars, fats and more vegetables

take part, thanks to their antioxidant, anti-inflammatory and insulin-potentiating properties, in the prevention of :

overweight,

cardiovascular disease,

of metabolic syndrome and type 2 diabetes,

inflammatory diseases

and recently demonstrated, intestinal dysbiosis.

The limits

Effective daily doses with no side effects remain empirical and further intervention studies are needed to better define them

The risk of contamination by pesticides and heavy metals should not be underestimated. It can be dangerous to consume imported herbs and spices without traceability in accordance with European legislation.

As a rule, the cultivation of spices requires few pesticides and herbicides. It is their storage that can represent a risk of toxicity with contamination by bacteria or microorganisms. Control of growing conditions, storage conditions and analytical quality are therefore essential.

These limits do not call into question the interest of the consumption of aromatic herbs and spices for human health, but they underline the dangers of not providing information in the field of nutrition as well as in the more general framework of our environment.

5. Messages to remember

The regular use of culinary herbs and spices goes far beyond the simple search for taste pleasure, because introducing them into our eating habits, allows us to acquire healthy eating habits and participates in the nutritional prevention of non-communicable diseases with a nutritional component.

However, clinical research still needs to progress as the optimal doses of herbs and spices in the prevention of pathologies and the mechanisms of action are not yet fully known.

Notes and References

Cover image. Spice market.

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