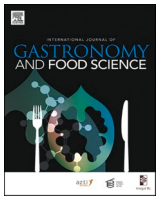
International Journal of Gastronomy and Food Science 35 (2024) 100854

Contents lists available at ScienceDirect

International Journal of Gastronomy and Food Science

journal homepage: www.elsevier.com/locate/ijgfs



Garlic: Tracing its changing popularity in British cuisine

Charles Spence

Department of Experimental Psychology, New Radcliffe House, University of Oxford, Oxford, OX2 6BW, UK

ARTICLE INFO

Keywords:
Garlic
Body odour
Functional foods
Class
Foreign

ABSTRACT

Garlic, which was originally used medicinally, has become increasingly ubiquitous as a culinary ingredient in recent years. However, its popularity in British cooking has risen and fallen repeatedly over the centuries. While some commentators, perhaps most notably Mrs. Beeton, once described it as smelling 'offensive', other commentators nowadays claim that it imparts a gorgeous flavour to both savoury and sweet foods. Various explanations for garlic's mixed culinary fortunes are discussed, including the antimicrobial hypothesis, the perception of garlic as a 'foreign' ingredient (at least by those living in Britain), the malodour (garlic breath) long associated with those who have recently consumed this pungent allium, and the contemporary perception of it as a functional food. Given that it is difficult to assess whether the availability of different cultivars may have resulted in those living in Britain simply being exposed to less pungent varietals nowadays than previously, it remains uncertain just how much people's tastes (i.e., preferences) have changed as the years have gone by versus whether today's commercial alliums are simply less pungent than once they were.

1. Introduction

As Eric Block notes in the opening sentence of his article in *Scientific American* on *The chemistry of garlic and onion*: "The world has always been divided into two camps: those who love garlic and onions and those who detest them." (Block, 1985, p. 114). In 1861, Isabella Mary Beeton, author of the hugely popular *Mrs. Beeton's Book of Household Management*, described garlic as smelling 'offensive', continuing that 'it is the most acrimonious in its taste of the whole of the alliaceous tribe' (Beeton, 1861, p. 190),[1] thus suggesting that she fell squarely into the latter camp. Beeton suggested that it was sufficient merely to rub a cut clove of garlic around the inside of the dish in/on which the substance to be flavoured is to be served. In her book of salad recipes, *Green salads and fruit salads*, Mrs. C. F. Leyel (1925) recommends rubbing salad bowls with garlic, rather than incorporating the allium into the dish itself (Leyel, 1925). The precautionary approach to the use of the herb can also be seen in the cookery books of Eliza Acton (1799–1859) and Dr. William Kitchiner (1817). Colin Spencer (2003, pp. 253–254) attributes Acton's nervousness – in particular, changing the water in which the garlic is boiled three times in a 15–25 min cooking time to make the taste/flavour especially mild in a mild ragout of garlic or *L'ail à la Bordelaise* – to her being relatively unfamiliar with the allium (cf. Palazzolo et al., 2018, for the effects of cooking on bioaccessibility; and Ueda et al., 1990, for the flavour constituents in the water extract of garlic). Kitchiner, meanwhile, suggested making a vinegar of garlic, and allowing the guests to add flavour to their own sauce to taste.

The London-based French chef, Alexis Benoît Soyer (1810–1858), also recommended leaving the garlic out of salads if ladies were to be present at a meal because he thought that they would dislike its strong taste (see Attar, 1991, p. 138; Soyer 1845, 1849). Garlic is mentioned 25 times in Soyer's (1849) *The modern housewife or, Ménagère*. In contrast to Mrs Beeton's volume, which contains somewhere in the region of 80 mentions, Acton's book contains only two recipes that include garlic (Acton, 1845), while there are 40 mentions in Kitchiner's volume. At one point, Kitchiner (1817, p. 63) writes that: "Besides the ingredients I have enumerated, many culinary scribes indiscriminately cram into almost every dish (in such inordinate quantities, one would suppose they were working for the *asbestos* palate of an Indian fire-eater) anchovies, garlic, bay-leaves, and that hot, fiery spice, *Cayenne* pepper". One finds just four mentions of 'garlick' in Hazlitt's (1902), *Old cookery books and ancient cuisine*.

Nowadays, garlic is very much in vogue, and is seemingly ubiquitous

E-mail address: charles.spence@psy.ox.ac.uk.

[1] Beeton writes that: "The smell of the plant is usually considered offensive, and it is the most acrimonious in its taste of all the alliaceous tribe. In 1548 it was introduced into England from the shores of the Mediterranean, where it is abundant, and in Sicily it grows naturally. It was in greater repute with our ancestors than it is with ourselves, although it is still used as a seasoning herb. On the Continent, especially in Italy, it is much used, and the French consider it an essential in many made-dishes." (Beeton, 1861, p. 190).

https://doi.org/10.1016/j.ijgfs.2023.100854
Received 29 June 2023; Received in revised form 5 December 2023; Accepted 8 December 2023
Available online 15 December 2023

in British cuisine, with people not only using the bulb but also the green stems and white flowers (e.g., in salads). According to the results of a poll conducted for National Garlic Day (and reported in the popular press), the average Brit uses half a clove every day, with 40% of the 2000 people surveyed wanting to put the pungent ingredient in all their meals (Hearn, 2021).[2] One in ten of those quizzed even suggested that they would buy garlic-flavoured chewing gum were it to be made available. A few years ago, one of Britain's master chocolatiers, Paul A. Young, even developed a caramelised garlic chocolate for Halloween 2014, roasting the clove and combining it with a ganache (Ross, 2015). Black garlic has recently become a popular addition to beer, chocolate, and ice cream, supposedly because of the 'gorgeous' flavour that it imparts (Barnott--Clement, 2021), not to mention the 'instagrammability' of this unusually-coloured allium (Carter, 2011).[3]

The Roman poet Horace once described garlic as being so potent that it could send one's lover to the other side of the bed (Bradley, 2015; Coucquyt et al., 2020, p. 110). Contrast this with the contemporary North American commentator who suggests that the sharing of garlic bread constitutes an excellent way to improve family interactions (Hirsch, 1999, 2000). According to the popular press, sautéed garlic scented candles are apparently all the rage in certain circles currently (Parker, 2023).[4] Over the last 50 years or so, sales of garlic have grown rapidly in many countries including the UK, Australia, and North America. For instance, according to data from Parker (2004), the most popular fresh herbs and spices by amount spent by Australian shoppers in major supermarkets (by weight) were garlic, ginger, and chilli. The fact that some herbs and spices, such as onions, leeks, garlic, and chives are also classed as vegetables, complicating the story here somewhat. Around the turn of the century, garlic was also the best-selling herb in the US (see Hasler, 1998). Indeed, garlic products are amongst the most popular herbal supplements in the US (Amagase et al., 2001). However, it is difficult to come by statistics charting changes in the consumption of garlic over the years specifically in Britain, and the global increase in consumption is hard to interpret from a national perspective.[5]

Nevertheless, it is relevant to ask what changed popular opinion in Britain so completely from garlic once being described as smelling offensive and tasting acrimonious (Sokolov, 1975, describes it as 'A plant of ill repute') to nowadays being described as a delicious taste/-flavour, one that is increasingly being incorporated in a wide range of both savoury and sweet dishes? Is it the case that garlic tastes/smells the same, but it is our preferences that have changed (see Spence, 2023), or has the taste of garlic itself changed as a result of less pungent cultivars of this allium being grown (see Shemesh-Mayer and Kamenetsky, 2021)? Certainly, the 'tear-inducing odour of garlic' (Clements, 2015, p. 59) feels like something that may have been more common in the past than it is today.[6] As discussed below, what we choose to eat, and how we rate the experience, is influenced by a wide range of factors including everything from religion to politics, price, tradition, availability, genetics, fashion, geography, but also as will be the focus here, a product or ingredient's sensory properties, etc. This focus on the sensory rather than physico-chemical properties of foods stands in contrast to the claims made by certain molecular gastronomists that the taste of deliciousness can be explained in terms of the latter (e.g., Barham et al., 2010; see also Spence and Youssef, 2018), or by those evolutionary biologists who have argued that deliciousness targets that which is essential for an animal's survival (Dunn and Sanchez, 2021); Presumably, our liking for that which is essential should not change much over time.

2. Garlic's origins and spread

Garlic was first used and cultivated[7] in Central Asia c. 10,000 years ago (Jay, 2016; Shemesh-Mayer and Kamenetsky, 2021; Vavilov, 1951; though see de Candóle, 1908, for an alternate suggestion), with various claims for its early popularity being associated with its medicinal use in China. *Allium* is the largest and most important representative genus of the Alliaceae family and comprises 450 species, widely distributed in the northern hemisphere. Besides the well-known garlic and onion, several other species are widely grown for culinary use, such as leek (*Allium porrum* L.), scallion (*Allium fistulosum* L.), shallot (*Allium ascalonicum* Hort.), wild garlic (*Allium ursinum* L.), elephant garlic (*Allium ampeloprasum* L. var. *ampeloprasum*), chive (*Allium schoenoprasum* L.), and Chinese chive (*Allium tuberosum* L.) (see Figs. 1–3).

Block (1985) suggests that garlic (*Allium sativum* L.) is one of the world's oldest cultivated plants. In fact, alliums feature in the world's oldest cookbook (Block, 2009), with garlic listed amongst the ingredients of Babylonian recipes such as wild fowl pie etched on clay tablets in Akkadian cuneiform script around 1750 BC[8] The United Nations Food and Agriculture Organization (FAO) estimates that approximately 10 million metric tons of garlic is produced annually. Garlic has been vegetatively propagated for millennia (Zheng et al., 2007), and has long been a popular ingredient in the cuisines of certain parts of what is now China (see Zhao, 2015). 2000 years ago, garlic constituted part of the daily diet in China and was eaten with raw meat (Kahn, 1996; Moyers, 1996). Indeed, according to Zhao's, *A history of food culture in China*, garlic was useful for ridding fish and meat of any pungent odours and imparting a pleasant aroma. Indeed, historical documents contain the regions and varieties of garlic available since the Han Dynasty (206 B.C.–220 A.D.; Zhao, 2015, p. 86). Some marked regional differences in usage have also been noted though. For example, according to Zhao (2015, p. 86), garlic is not used in areas around the Zangtze river delta due to its sharp smell. In the Gangshang country of Shandong Province, people consume 20 g or more of garlic per day, whereas in the neighbouring Qixia country, they eat (or ate) less than 1 g daily (Mei et al., 1982).

According to Ekşi et al. (2020), the primary centre of the evolution of the genus extends across the Irano-Turanian geographical region, and the Mediterranean (e.g., Friesen et al., 2006; Fritsch and Frisen, 2002; Hanelt, 1990; Rabinowitch and Brewster, 1990; Witczak, 2006). While garlic may be native to most parts of the world, excepting the Americas (Petrovska and Cekovska, 2010), central Asia is home to by far the largest number of cultivars (c. 120), meaning that it continues to be the main centre of garlic biodiversity globally (Kamenetsky et al., 2005). China currently produces the vast majority of the world's garlic (i.e., growing 74% of the 28 million tonnes of garlic produced in 2020; see Garlic Production in 2020: Crops/World Regions/Production Quantity, 2022).

[2] With the exception of breakfast, one imagines (see Spence, 2017).

[3] Garlic turns black as a result of the Maillard effect when treated with temperature and high humidity for three weeks. The sulphurous enzymes and amino acids are converted to sugars during this natural aging process, thus resulting in a loss of heat/pungency in the taste/flavour.

[4] Who knows, perhaps this can be considered as an extension of the gourmand perfume trend (see Bulliqi, 2018).

[5] Though according to a press report from Davies (2023), there has been a 5% annual increase in sales of spices in the UK, thus making the UK the fifth largest importer of spices in world.

[6] Potentially relevant here, refrigerated storage tends to cause a decline in distinctively garlicky flavour, and an increase in more generic onion flavours (McGee, 2004).

[7] *Allium sativum* (cultivated garlic) and *Allium ursunum* (wild garlic) are part of the lily family (Nagourney, 1998).

[8] One also finds mention of garlic in the lament of the exiled Israelites in the Bible's Old Testament: "We remember the fish, which we did eat in Egypt freely; the cucumbers, and the melons, and the leeks, and the onions, and the garlic."

Fig. 1. Image taken from f. 5 of Tractatus de herbis (Herbal); De Simplici Medicina (index Secreta Salernitana); Circa instans; Antidotarium Nicolai. Written in Latin. In public domain, downloaded from https://picryl.com/media/asphodel-and-garlic-from-bl-eg-747-f-5-b9d264.

Fig. 2. Garlic leek (*Allium scorodoprasum*). Public domain photo of botanical artwork, 14th-15th century. In public domain, downloaded from https://picryl.com/media/garlic-leek-allium-scorodoprasum-thum-kurrathi-top-charlock-brassica-alba-khardal-e8f6cb.

3. Garlic's early medicinal use

In ancient times, garlic was used medicinally, with a wide range of health benefits putatively being ascribed to the allium (e.g., Dubick, 1986; Fenwick and Hanley, 1985a, b; Nagourney, 1998). In fact, garlic represents one of the earliest documented examples of a plant being used for health and the treatment of disease (Londhe et al., 2011; Rivlin, 2001). The Sumerians (2600-2100 B.C.) used garlic extensively for its purported healing properties (Petrovska and Cekovska, 2010; Tannahill, 1973, p. 47). According to Block (1985, p. 114): "The Codex Ebers, an Egyptian medical papyrus dating to about 1550 B.C., gives more than 800 therapeutic formulas, of which 22 mention garlic as an effective remedy for a variety of ailments including heart problems, headaches, bites, worms and tumors." In Ancient Egypt, slaves were given garlic and onions to eat to help ward off illness (Collectif, 1964; Moyers, 1996; Straudal, 1992; Tackholm and Drar, 1954). Classen et al. (1994) write that the ancient Egyptians fed their slaves porridge with garlic. Garlic was also given to the original Olympic athletes in Greece and can perhaps be considered as the first performance-enhancing drug (Block, 1985, 2009; Crawford, 1973; Rivlin, 2001)! Meanwhile, in Ancient Rome, sailors and soldiers ate garlic because it was believed to aid their strength and endurance. Aristotle, Hippocrates and Aristophanes all recommended garlic for its medicinal effects. Furthermore, the Roman naturalist Pliny the Elder also cited numerous therapeutic uses for garlic (Block, 1985). Roman quartermasters were known to keep substantial supplies of garlic to treat wounds (Jones, 1996).

In the late 16th and early 17th centuries, King Henry IV of France was baptized in water containing garlic to protect him from evil spirits and probably also from disease (Rivlin, 2001). The belief that garlic was a medicinal plant appeared in English-language medical texts up until the opening years of the 20th Century (see also Hobbs, 1992).[9] According to Lemery (1702, p. 109), the smell of garlic was capable of driving out snakes (see also Petrovska and Cekovska, 2010). Garlic's purported role in helping to ward off vampires in popular folklore should also be mentioned here (Maas and Voets 2014; cf. Sandvik and Baerheim, 1994). This myth may have originated in the Balkans in the medieval era, at a time when garlic was used medicinally to help fight various diseases including those of the blood (see Block 1986; Nagourney, 1998).

[9] As Rivlin (2001, p. 954 S) points out: "*The Home Book of Health*, authored by John Gunn in 1878, featured garlic prominently; it was recommended as a diuretic, for treatment of infections, as a general tonic and for asthma and other pulmonary disorders (Moyers 1996). In the early part of the 20th century, in the volume *Health Remedies, a Complete Medical Work and Family Guide*, garlic was promoted for diseases of the lung in children and adults."

Fig. 3. Hieronymus Bock. Kräuterbuch. In public domain, downloaded from https://picryl.com/media/bock-wald-knoblauch-hunds-knoblauch-aber-knoblauch-978fda. https://picryl.com/media/garlic-leek-allium-scorodoprasum-thum-kurrathi-top-charlock-brassica-alba-khardal-e8f6cb.

Indeed, during the First World War, garlic juice was used as an antiseptic for wounds (Butt et al., 2009; Jones, 1996; see also Yadav et al., 2015). A little over a century ago, at the height of the so-called Spanish flu influenza epidemic (i.e., in 1917–1918), North Americans would walk around with a chain of garlic round their necks in the belief that it offered them some protection (Petrovska and Cekovska, 2010). In fact, garlic was once described as 'Russian penicillin' because Russian physicians were still using it to treat respiratory tract diseases and other ailments up until the Second World War, even though penicillin had by then already been discovered (Petrovska and Cekovska, 2010).

4. Contemporary medicinal findings

It has long been known that garlic has antimicrobial, antithrombotic, antihypertensive, lipid-lowering, antiaging, and even cancer-preventative properties (see Arora and Kaur, 1999; Corzo-Martínez et al., 2007; Hughes and Lawson, 1991; Khanum et al., 2004; Londhe et al., 2011; Milner, 1996; Nagourney, 1998; Reuter, 1995; Ross et al., 2001; Loeper and Debray, 1921, for what is perhaps the earliest report concerning garlic's effect on blood pressure). In conclusion, various seemingly independent cultures would all appear to have come to the same conclusion that garlic provides an effective treatment for pulmonary and respiratory complaints (Rivlin, 2001). However, a double-blinded, placebo-controlled trial conducted by Rajan et al. (2005) failed to provide any support for the suggestion that the consumption of garlic acts as an effective mosquito repellent.

The consumption of garlic has also been reported to lower the total cholesterol concentration by approximately 10% (Londhe et al., 2011). However, according to the latest research, there is little convincing evidence that garlic reduces plasma lipoprotein (Sahebkar et al., 2016). The results of a systematic review and meta-analysis of seven randomized, placebo-controlled studies conducted by Xiong et al. (2015) highlighted a significant drop of both systolic and diastolic blood pressure in those taking garlic when compared with the placebo (see also Banerjee and Maulik, 2002; Ried, 2020; though see Stabler et al., 2012, for contradictory conclusions from a Cochrane Systematic Review of garlic's effect on cardiovascular morbidity). However, as is so often the case with medicinal meta-analyses, further longer-term follow-up studies are still needed, according to Xiong and colleagues.

Another recent review of both epidemiological and laboratory studies support the view that garlic reduces the incidence of certain cancers (e.g., stomach, colon, mammary, and cervical; Khanum et al., 2004). The resurgence in garlic's popularity over the last two or three decades is, at least in part, related to it being a functional food (e.g., Block, 1998; Hasler, 1998, 2002; Meyer, 1998; Nagourney, 1998; Rosin et al., 1992; and see Jones, 2022, for some very recent popular press coverage). Amongst vegetables, garlic has very high antioxidant activity (Chen et al., 2013; Halliwell et al., 1992; Vinson et al., 1998), and is the most commonly quoted herb in the literature for its medicinal properties (Ahmad, 1996; Nagourney, 1998). Singh and Singh (2008) have also documented the pharmacological properties of garlic. Looking to the future, it is interesting to note how some commentators see a role for garlic in helping to reduce/replace salt in our diet (e.g., see 'Guidance: School food standards practical guide', 2022) hence, potentially, having an indirect beneficial effect on our health. Though here one also needs to consider how garlic may interact with other ingredients such as pepper in real foods (Rosin and Tuorila, 1992).

5. Garlic's rise and fall as a culinary ingredient in England

Garlic was first introduced into England in the decades following William the Conqueror's 1066 invasion (Bush, 2020). In 1086, William commissioned the Domesday Book, providing him with a complete account of his newly-acquired land, the people who lived there and, more importantly for the context of this paper, what crops they grew. It turned out that what they mostly grew was turnips (a root vegetable). According to one suggestion, William had the turnip fields ripped up and replanted with garlic (Jervis et al., 2016). Contradicting this suggestion, however, Colquhoun (2007, p. 39) in *Taste: The story of Britain through its cooking* suggests instead that vegetable plots in the 10th century would already have been planted with plenty of garlic. By the 12th and 13th centuries, garlic was a ubiquitous staple grown by English peasants (Classen et al., 1994, p. 66; Spencer, 2003, p. 65). During this period, garlic-mongers were reported wondering the streets of London and Oxford (Dyer, 1999), much as they wondered the streets of ancient Pompeii (Koloski-Ostrow, 2015, p. 103), and Turkey (Ekşi et al., 2020).[10] The medieval English recipe book "The Forme of Cury" (14th century; Pegge, 1780) includes garlic as an ingredient of the Verde Sauce as well as in salad.

Petrovska and Cekovska (2010) suggest garlic was reintroduced into Great Britain in 1548, from the Mediterranean coasts where it was

[10] Echoing the link between peasants and garlic, Don Quixote advises Sancho Panza: "Do not eat garlic or onions, for their smell will reveal that you are a peasant" (Cervantes, 1605).

widespread (although no explanation for why it should have disappeared is given). Published a little over 50 years later, Shakespeare famously warned the actors in *Midsummer Night's Dream* (probably written 1594–1596) not to eat garlic (because of bad breath): "And, most dear actors, eat no onions nor garlic, for we are to utter sweet breath, and I do not doubt but to hear them say it is a sweet comedy." However, by the 17th Century, one finds the English intellectual John Evelyn (1620–1706), famous for his influential manuscript recipe book, refusing to countenance garlic being added to his salads, for fear that it might offends the ladies.[11] He also suggested that it had become associated with the poor, claiming that it should be kept for northern rustics "especially living in uliginous and moist places" (Spencer, 2003, p. 156; see Classen et al., 1994, p. 34). A report from the early seventeenth century on the prospects for Dutch trade in the Baltic lamented that 'they are not at all used to pepper, sugar, wine, and such delicacies, and are better off with their garlic, brandy, and honey.' (G. V. Forsten, *Akty ipis'mak istorii baltijskogo vaprosa* (St Petersburg, 1893), ii. 110; as cited in Smith, 2007, p. 243). Colquhoun (2007, p. 247) reports that French chefs working in London (incuding Carême, 1783–1833), who cooked for the likes of the Prince Regent (i.e., during the Regency period) used garlic, which had been "hardly tolerated a generation earlier", only sparingly in recipes (see also Williams, 1835, Section 2, pp. 122–125, for complaints regarding the overuse of garlic in French cuisine).

After several centuries in the culinary wilderness, garlic once again became popular during the Victorian era, when French tastes were considered the height of sophistication in Britain (Ross, 2015), before rapidly falling out of favour once again during the Second World War: According to the food historian, Ivan Day, it was seen as 'foreign muck' by the generation who had been forced to live off bully beef, so-called 'variety meats' (Cline, 1943; Time-Life, 1982; Wansink, 2002), and reconstituted egg and had acquired a taste for simplicity. Day goes on to suggest that "As recently as 30 years ago in many parts of Britain, cooking with garlic was considered "foreign" or eccentric." (again quoted in Ross, 2015).[12] Here, one gets the sense of odorous being associated with racial or cultural stereotypes (see Fretwell, 2020; Hoffer, 2005; 'The odor of race', 1904). Recipe books from the 1950s contain few mentions of herbs and spices, with mild herbs such as dill and thyme slowly starting to make an appearance over the following decade (Ross, 2015). One does not find much mention of garlic in the recipes of Britain's first TV celebrity chef Fanny Cradock (see Ellis, 2007). Day describes the fake salamis that were popular in the 1960s. He was quoted as saying that: "They were so strong with garlic but they weren't real salamis – not as we know them now". He recalls: "At first, most people were rude about garlic, and then, after the war – as more people began to travel – it gradually became more popular." (quoted in Ross, 2015).

In fact, it may well have been the growing appeal of Mediterranean cuisine that led to the resurgence in popularity of garlic in the latter half of the 20th Century (Ross, 2015). The influential food writer/cook Elizabeth David (e.g., David, 1950; David, 1987) helped to popularize Mediterranean cuisine in the UK in the decades after the Second World War (i.e., after the rationing of the war years). In her *Summer Cooking*, first published in England in 1955, David encouraged her readers to embrace the herb (David, 1955). Notably, a picture of garlic also adorned the front cover of David's (1962) *French Provincial Cooking* cookbook. As such, David's cookbooks may well have helped to reintroduce the British public to the culinary delights of garlic (see Renoux, 2005, pp. 21–25, on the use of garlic in Mediterranean cuisine). Indeed, when discussing David's influence on British cuisine, Kate Colquhoun notes that sales of garlic presses soared in the mid-1950s.[13] Meanwhile, Len Deighton titled his French cookery book *Où est le garlic: French cooking in 50 lessons* (Deighton, 1965). Weiss (2002, p. 76) describes "the great French culinary watershed marked by the butter/olive oil line, or otherwise stated, the great garlic divide", meaning that "garlicky" is a quality that is specifically associated with Provençal cuisine.

While celebrity chefs have sometimes been credited with popularizing unusual ingredients amongst the British public – a phenomenon known as 'the Delia Effect' (Singh, 2009), and thereafter 'the Heston Effect' (Nolan, 2013) – none of the contemporary star chefs have, at least as far as I am aware, tried to promote the wonders of garlic to the British public. At the same time, however, it is easy to imagine that Britain's long affinity with Indian food (Mukherjee, 2017) might also have exposed many people to the pleasures of garlic, no matter whether they could taste it in amongst the other pungent spices or not (though see Bickham, 2008).[14] More recently, one might consider how the growing popularity of Thai cuisine in the UK (e.g., Plunkett-Hogge, 2022) may also have helped to increase British people's exposure to this pungent allium when eating out.

6. Why use garlic as a culinary ingredient in food?

Given how pungent many people seem to find garlic, one might wonder what exactly it is doing in food, especially given the limited nutritional benefits that it provides (see Block, 1985; 2009; Moyers, 1996). According to Sherman and Flaxman (2001, p. 146), most people initially find pungent spices such as garlic, ginger, anise and chilli distasteful (see also Steiner, 1974, 1979). At the same time, however, it is worth considering how a preference for garlic can be established in utero, if it forms part of a mother's diet (Hepper, 1988). This is because of allicin's ability to flavour the amniotic fluid if it forms part of a pregnant mother's diet.[15]

Over the years, several plausible explanations have been put forward for the presence of garlic and other herbs/spices in our cuisine, albeit operating over very different timescales. In particular, according to the antimicrobial hypothesis (sometimes referred to as the adaptive cuisine hypothesis), herbs and spices may originally have been added to food for their antimicrobial properties. It turns out that garlic is one of the most effective of antimicrobial agents/ingredients (Ankri and Mirelman, 1999; Spence, 2021a). According to Billing and Sherman (1998), the four most potent herbs and spices (garlic, onion, allspice, and oregano) killed all of the bacterial species frequently implicated in food-borne illness that they were able to find data on. The antibacterial properties of garlic were first commented on in the scientific research of Louis Pasteur (1858).

One of the predictions of the antimicrobial hypothesis is that there should be a correlation between the average temperature of a country/culture and the mean number of herbs and spices in the dishes that one finds prepared there, given the increased risk of microbial issues in warmer climates (especially prior to the widespread refrigeration of food). Support for the latter prediction comes from research showing that India, a country with one of the highest mean annual temperatures ($M = 26.9\,^{\circ}C$) also incorporates the highest average number of herbs and spices in its recipes ($M = 9.3$), while the country with the lowest mean

[11] Loathing garlic, Evelyn (1699, p. 27) writes: "… we absolutely forbid it entrance into our salleting by reason of its intolerable rankness … sure tis not for ladies palats".

[12] It is interesting to consider which ingredients are considered 'foreign' and so shunned, and which are considered 'exotic' and thus highly prized (Schivelbusch, 1993).

[13] David's book *Mediterranean Food* came out in mass market paperback edition in 1954. The garlic press was invented around 1950 by Swiss designer Karl Zysset (see https://www.eguide.ch/en/objekt/zylyss/).

[14] Garlic did not, though, appear in the recipe of the first Indian dish to be published in England (see Glasse, 1747).

[15] Given such findings, it is intriguing to note that Hippocratic physicians and Aristotle would use garlic to determine whether a woman could conceive or not. "Having washed and peeled a head of garlic, apply it to the womb, ad see the next day whether she smells of it through the mouth; if she smells, she will be pregnant, if not, she will not." (quoted in Totelin, 2015, pp. 24–25).

annual temperature (Norway, M = 2.8 °C) has the lowest mean number of herbs and spices (M = 1.6). In fact, according to research conducted by Sherman and Billing (1999), there is a significant correlation between the culinary use of herbs and spices and a country's mean annual temperature (Ohtsubo, 2009; and see Spence, 2021a, for a review). One of the other predictions to emerge from the antimicrobial hypothesis is that more herbs and spices should be found in recipes for meat dishes than in vegetarian dishes, given the increased risk of food-borne microbial infection in the former case. This prediction was supported by the results of an analysis of a large number of recipes by Sherman and Hash (2001; though see also below).

Recent research has revealed that there is actually little empirical support for the antimicrobial hypothesis, once the statistical artifact known as phylogenetic non-independence has been eliminated from the relevant analyses (Bromham et al., 2021). Bromham and colleagues argue that when analysed appropriately the data on the distribution of spice use in different countries/regions can better be explained in terms of a broader association between spice consumption, and socioeconomic variables that reflect global patterns of poverty and health outcomes. These researchers analysed a representative global dataset of 33,750 recipes from 70 cuisines containing a total of 93 different spices. Their findings demonstrate that variation in the use of spices cannot be explained by temperature and nor can it be accounted for by the diversity of cultures, plants, crops, or naturally-occurring spices. While spicier foods do, on average, tend to be found in hotter countries, this doesn't necessarily provide support for the hypothesis that patterns of spice use represent a cultural adaptation to mitigate the risk of infection. Thus, given the lack of support for the antimicrobial hypothesis, one might consider the merit of another former account of the use of herbs and spices, namely that they were used to mask off-taints in the era prior to refrigeration (Spence, 2021a). One might consider the use of strong-flavoured and smelling foods in the Roman era in just this light (see Classen et al., 1994, p. 22).

7. What is garlic doing in British cuisine?

Let us then return to the question of how the shorter-term fluctuations in garlic's popularity in the UK over the last century or so that were mentioned earlier are to be explained. Here, one presumably needs to consider the influential role that empire and commonwealth have undoubtedly played in shaping British cuisine. Despite the fact that Britain has a very eclectic cuisine (given the incorporation of many foods/ingredients from the former empire; Bickham, 2008), it is nevertheless still possible to talk about distinctively British foods (e.g., see Colquhoun, 2007; Mason and Brown, 2006; Spencer, 2003). At the same time, however, it is important to recognize that while there may be a resistance to the use of certain herbs and spices because of their association with 'otherness', the flipside of this is that it is their very exoticism that has long attracted people to spices at certain points in history (e.g., Schivelbusch, 1993). Notably, garlic did not feature as one of the exotic spices popularized by the Crusaders when they returned from the East. In part, this is presumably because garlic would already have been familiar as a wild herb that was commonly found in church courtyards throughout the land (see Petrovska and Cekovska, 2010). So while black pepper and other spices became increasingly popular from 1400 to 1700, garlic is not mentioned prominently (Colquhoun, 2007; Wake, 1979). According to Classen et al. (1994, p. 66), only the rich could afford the exotic spices for their medieval banquets, whereas the peasants had to make do with simple seasonings, such as mint, garlic, and onion.

Monastic texts also considered garlic to be a medicinal plant, and it would have been a common plant in cloister gardens during the Middle Ages. According to the records, Glastonbury Abbey once used 80,000 bulbs of garlic a year, equating to about one quarter of a bulb per person per day (though note that the bulbs would have been much smaller then; Tannahill, 1973). Weeds such as Jack of the hedge (hedge garlic) also have a mildly garlicky flavour, though it is unclear if/when their consumption became widespread (see Spence and Spence, 2023).

It is sometimes said that the British have treated garlic with suspicion ever since the Romans left (cf. Rivlin, 2001), though alliums only appear in seven recipes in Apicius (1936), which makes little mention of onions either (Potter 2015). Instead, half the recipes in Apicius contain asafoetida, a resinous gum from Iran, which also imparts a sulphurous/alliaceous note to food (Segnit, 2010, p. 114). In the UK, one of the primary reasons for people's opposition to garlic is its perceived 'foreignness' – being associated in the popular imagination with the French during the last century. So, for example, when Sid James played Henry VIII in the *Carry On Henry* film (which was released in cinemas in February 1971), his character complained of his French wife Katherine of Aragon that she smelled of garlic, playing to this stereotype. The hugely popular 1980s BBC TV sitcom *'Allo 'Allo!* also helped to reinforce the link (Clark, 2022). In her book, *The Scent of Desire*, the North American scientist Rachel Herz (2007, pp. 169–170) perpetuates the stereotype when she writes that: "Starting with perfumes in the 1920s, numerous attempts have been undertaken to improve the odour quality of the Paris metro and to overwhelm, with something better, that mélange of garlic, Gauloises, stale perfume, body odour, and axle grease that wafts through the underground rail system." Meanwhile, in her book *Food in History,* Reay Tannahill (1973, p. 195) includes the following anecdote: "A few years ago one French astronaut – apparently unaware of these findings – took some garlic-laden delicacies along with him on a Soviet space flight. The air conditioning, it was subsequently reported, proved unable to cope." This statement links to a discussion of the odorous emissions of those who eat garlic, and references an article that had appeared in the British press.

The Spanish press has also commented on the smell of garlic and its foreignness to a certain famous Brit (see Bonnici, 2012; and see Ford, 1846, pp. 178–179, for an earlier comparison between Spain and Britain). Meanwhile, Ballou (1897, p. 174) writes that: "The recipe to resuscitating an Englishman is to hold a beefsteak under his nose. A Spaniard or a Frenchman, may be revived by garlic..." For the historic use of garlic in Italian recipes, see Waters (1997).

8. Garlic breath, malodour, and class

What people often object to is not so much the taste/aroma of this particular allium, but rather the smell that other people have after having eating garlic/garlic-flavoured foods. The odour of garlic results from the breakdown of sulphur-containing compounds which is characteristic of this family of plants (Block, 2009). Crocker (1945, p. 46) wrote of how: "Onions and garlic are sweet bulbs flavoured with minute quantities of intensely odiferous sulphur compounds that are not well known" (and see Lanzotti, 2006, for more recent evidence). Rachel Herz (2007, p. 225) goes so far as to suggest that bad garlicky and sulphurous aromas are capable of inspiring fear, perhaps due to the historic association with the sulphurous smell of hell/the devil (Critten and Kern-Stähler, 2016; Kettler, 2023; Spence, 2021b). Over 75% of the aroma molecules in garlic are sulphurous vegetal notes, while slicing or crushing garlic triggers chemical reactions leading to the creation of a range of additional sulphurous aroma molecules (Brodnitz et al., 1971; Coucquyt et al., 2020, p. 110). Crucially, one of the key compounds,

allicin (Borlinghaus et al., 2014), is metabolized and partially excreted through the lungs, hence the malodorous breath (often referred to as "garlic breath"; see also Shusterman, 2016) in those who have recently eaten this particular allium.[16] The fact that allicin is perceptibly excreted by the respiratory organs, may have been the reason why is was once used to treat respiratory tract diseases (Petrovska and Cekovska, 2010).

It is unclear when people first found the flavour of garlic to be delicious rather than pungently offensive,[17] rather than necessarily the flavour that it imparted to food. One does, however, find French commentators complaining about the odour of those who had recently come into contact with this allium. So, for example, according to Muchembled (2021, p. 103): "Garlic and rue were considered to smell vile. Jean Liebault wrote in 1582 (p. 506, 513, 551) that garlic gave people bad breath and made their excrement stink." (Liébault, 1582).[18] The odour of garlic on the breath has long been considered deeply unpleasant (Mennell, 1985; Sokolov, 1975).

However, in contrast to coriander/cilantro whose appeal (or otherwise) appears to be largely genetically determined (e.g., see Eriksson et al., 2012; McGee, 2010; see also Mauer and El-Sohemy, 2012), people's negative response to garlic would often appear to be driven by the differing associations that people have with garlic breath, that is with the odour of those who consume this pungent allium (the 'unsavoury breath' mentioned in the *Salerno Regimen*, the medieval medical teaching guide written in the 12th or 13th century, in Salerno, Lafaille et al., 1990; Tannahill, 1973, p. 194). The compound allyl methyl sulphide which is metabolized and excreted more slowly than the other sulphurous compounds resulting from the breakdown of the chemically unstable allicin is responsible for garlic breath (Coucquyt et al., 2020, p. 110; cf. Laakso et al., 1989). Allicin is also found in the green garlic plant (Arzanlou and Bohlooli, 2010).

Garlic has a reputation as being exceedingly smelly and, by extension, lower class (see Potter, 2015, p. 129). Similarly, early recollection of the odours associated with transport from French novelist Alphonse Daudet describes "the carriage of the poor with its odour of pipe smoke, brandy, garlic sausage and wet straw." ('La petit chose', 1886, quoted in Baroli, p. 151; this anecdote appearing in Schivelbusch, 2014, p. 77; see also Classen et al., 1994, p. 33). As an eighteenth-century English governess once remarked of the Russian serfs: "they need not lay by much to provide for Food; for they can make an hearty Meal on a Piece of black sour Bread, some Salt, an Onion, or Garlick." (Justice, 1746, p. 18). Such observations can perhaps be taken to suggest that it is not so much the specific taste/odour that garlic imparts to food that people object to, but rather the fact that it made those who ate it smell bad, and smelling bad was implicitly linked to the lower classes (see Corbin, 1986; Largey and Watson, 1972; Orwell, 1937, p. 159), and hence was something to be avoided.[19] As the historian Peter Hoffer writes: "In nineteenth-century American culture, to smell bad was to exhibit social inferiority" (Hoffer, 2005, p. 5). The fact that garlic was for millennia fed to slaves and frequently consumed by the labouring/working classes may well have helped to cement the negative, class-ridden associations of those who smell of garlic.

The odorous consequence of eating garlic may well help to explain Buddhist objections to alliums which may originally have been grounded in problems of ritual purity (Moyers, 1996). In the early days of Islam, the Prophet Muhammed is once said to have rejected a dish containing garlic (Tannahill, 1973, p. 194). Similarly, Chinese Buddhist monks would abstain from eating garlic and other alliums because they were classed as 'foetid' and excited the senses too much. Similarly, Hindu Brahmins also abstain from onion and garlic (Tannahill, 1973, p. 194). Meanwhile, the Jains of India avoid garlic as well as all root vegetables because they might contain living things. Intriguingly, the Brahmins and Jains use 'asafoetida', a resinous gum native to Iran to impart a pungent, alliaceous flavour to food (Iranshahy and Iranshahi, 2011). One relevant distinction here is between the Hindus who use asafoetida whereas Muslims cook with garlic (Classen et al., 1994; Tannahill, 1973, p. 271). In Iran, asafoetida is sometimes rubbed on to serving plates for meat (Segnit, 2010, p. 114), thus mirroring the recommendations found in British cooking, as described earlier.

In Ancient Greece, people were not permitted to enter the temple if they smelled of garlic, being called 'rank roses' (Petrovska and Cekovska, 2010), or 'stinking rose' (Coucquyt et al., 2020, p. 110). City dwellers in ancient Rome would sometimes refer to country folk as odorous garlic eaters, above all complaining that they smelled of goats and garlic (see Morley, 2015, p. 117; see also Classen et al., 1994, p. 34; Draycott, 2015; Megaloudi, 2005). Mark Bradley's edited volume *Smell and the Ancient Senses* contains a number of references to the poor and slaves smelling 'goaty' and 'garlicky' (Bradley, 2015). Classen et al. (1994, p. 34) highlight the distinction between rich and poor, city and country slaves (called Tranio and Grumio, respectively) that appears in Plautus's play *Mostellaria* (c. 210 B.C.; Duckworth, 1942, p. 623):

Tranio: You smell of garlic. You thing of filth, you hick, goat, pig-sty, you mud-and-manure you!

Grumio: Well, what do you want? Everybody can't smell of [fine] perfumes just because you do, or sit at the head of the table, or live on the fine food you do. You can have your grouse and fancy fish and fowl. But let me go my way on a meal of garlic. You're rich and I'm poor, and that's that.

9. A most divisive ingredient

Garlic, much like coriander and Marmite, would appear to be a divisive ingredient amongst consumers. A quarter of a century ago, Nagourney (1998, p. 23) noted that: "Regarding the subject of odour-free preparations, one might wonder who established the odour of garlic to be offensive and that of cologne or mouthwash attractive?"[20] Mark Bradley (2015, p. 143) recounts how Vespasian once "revoked a military appointment when he encountered the young man in question doused in perfume, adding "I would rather you reeked of garlic"." One can only wonder as to whether together with its association with the lower classes smelling (bad) may also have slowed its incorporation in British cuisine.

When presented using the scratch-and-sniff technique, the odour of garlic was considered the least pleasant of the 18 food-related odours that were studied by Pangborn et al. (1988). Such a finding would seem to contradict the increasing popularity of garlic as a herb/spice. In this

[16] Garlic is one of the very few foods that can literally be tasted through the skin. If one puts one's sockless foot in a bag with garlic, then the taste of garlic in the mouth will be experienced roughly 30 min later (Spence, 2022). That said, occasional reports of burns and alliacious migraines have been reported amongst those suffering from overexposure (see Roussos and Hirsch, 2014; Sharp et al., 2018). Garlic allergy or allergic contact dermatitis to garlic is a common inflammatory skin condition caused by contact with garlic oil or dust. It mostly affects people who cut and handle fresh garlic, such as chefs (Kanerva et al., 2004, p. 396).

[17] Though, in truth, it was typically the lingering garlicky odour in those who had recently consumed garlic that commentators often criticized.

[18] The aversion to the smell of garlic amongst the French appears to have been overcome by 1980, when ethnological fieldwork in the Haut-Verdon region of the south-eastern French Alps revealed the local cuisine to be dominated by pairings of garlic with onion and thyme with bay leaf (see Ankri and Mirelman, 1999).

[19] The hit 2020 Korean movie Parasite, by direct Bong Joon-ho also played on the association between malodour and class (Lawless, 2020).

[20] And talking of mouthwash, one might wonder whether the rise of bad breath as a marketing opportunity for the likes of Listerine in the early 20th century (c. 1920) might also have negatively impacted the popularity of the one ingredient that has the most aversive impact on people's breath (Clark, 2015; Classen et al., 1994, pp. 182–186) on the 'invention' of halitosis).

case, the negative olfactory impression may have been due to the fact that garlic must be smelled and tasted in an appropriate food context in order to be liked. However, one might also consider whether impressions have changed over time (see also Schleidt et al., 1988, on German and Japanese participants' memories and associations with odours). A few years later, Rosin et al. (1992) questioned whether garlic should be considered as a sensory pleasure or a social nuisance? They highlight the somewhat contradictory views held around garlic's sensory (and health-related) properties. As the authors note: "With its possible therapeutic effects and pleasant flavour but unpleasant social consequences, garlic is an inspiring subject for food choice studies." (Rosin et al., 1992, p. 134).

The alternative suggestion that the taste of garlic has itself changed as the years have gone by finds little support in the literature – though note that the growing popularity of black garlic is likely attributable to the very different flavour profile it presents as compared to the fresh allium (Kim et al., 2013). Changes in the dominant cultivars available in different regions at different points in history may also help to explain differences in people's response to this allium's pungent or pleasurable flavour/aroma. One of the distinctions is between soft-neck and hard-neck varietals with the former more commonly found in British supermarkets but the latter having "the better flavour" according to Segnit (2010, p. 111). Soft-necked varieties do not produce flowering bolts, whereas hard-neck garlic types occasionally do (Benke et al., 2021). Elephant garlic, considered to be part of the leek family, also has a milder taste. Cold growing conditions produce a more intense garlic flavour (Atif et al., 2019).[21] Garlic is at its moistest soon after harvest, from late summer to late fall, and becomes more concentrated as it slowly dries out during storage (McGee, 2004). It is also relevant here to consider pickled garlic, given that this affects both the pungency and flavour. At the same time, however, according to the latest scientific research, garlic breath can be fixed by eating natural yogurt thanks to its neutralising proteins (Kaur and Barringer, 2023). Indeed, it was interesting to see how widely this study was picked up by the British press (e.g., Leatham, 2023), suggesting a continued sensitivity to the notion of 'garlic breath' (see also Castada et al., 2017, for the use of spearmint, peppermint, and chocolate mint leaves to deodorize garlic).

Garlic stands out, then as a most divisive food, more for the sensory attributes that it imbues upon those who eat this pungent allium, as for its taste/flavour. Meanwhile, Shemesh-Mayer and Kamenetsky (2021) make no mention of genetic modifications designed to lower garlic's pungency in their recent review of garlic breeding. It is also worth noting that until recently, garlic was propagated asexually by simply planting cloves of whole bulbs. According to Coucquyt et al. (2020, p. 110), selective breeding in the domestication of the garlic crop has taken place only over the last few centuries. Garlic is only propagated by cloves and has thus had restricted access to conventional breeding techniques. According to Shemesh-Mayer and Kamenetsky (2021), commercial garlic varieties are completely sterile and are propagated vegetatively. As a consequence of these features, there is a narrow genetic base with little variance in various traits of garlic (Benke et al., 2020; Zhao et al., 2011). Different garlic cultivars have very different sensory (and physical–chemical) qualities (Benke et al., 2021; Brar et al., 1994; González et al., 2009; Pardo et al., 2007; Singh and Tiwari, 1995). In *The Flavour Thesaurus*, Niki Segnit (2010, p. 111) recommends trying a side-by-side tasting of different bulbs, looking out for their different "hot, sweet, earthy, metallic, fruity, nutty, rubbery and floral (lily) characters." However, many consumers may instead simply choose to use powdered, flaked, paste and salt forms, or ready chopped in jars. Segnit (2010, p. 111) does, however, note that: "… these prepared products often have a piercing quality and miss the earthy, volatile perfume of fresh cloves."[22]

According to Pardo et al. (2007), recent selective breeding guidelines for garlic have tended to focus on the commercial bulbs' visual appearance (i.e., purple, white, or pink). Yield has also been another major area of research interest (Fanaei et al., 2014). A sensory analysis of several cultivars conducted by Pardo et al. found marked differences in pungency and garlic odour. In particular, the purple cultivar Morasol had the most intense pungency of the cultivars tested (while the white Ramses cultivar had the least pungent aroma), whereas the Chino Sprint, a Chinese cultivar had by far the most intense garlic odour. Natale et al. (2005) documented marked differences in pungency between five different Argentinian commercial cultivars, which were all highly pungent. While Pardo and colleagues assessed pungency using a trained sensory panel, Natale and colleagues assessed the concentration of enzymatic pyruvic acid. The most pungent cultivars were 'Castaño INTA' (96 μmol/g) and 'Nieve INTA' (95 μmol/g), while the least pungent cultivar of those studied was 'Fuego INTA' (65 μmol/g). In general, the red cultivars were less pungent than the white, purple and brown garlic cultivars. In the context of the present review, though, it is perhaps surprising to find that little attempt has been explicitly made to select cultivars with reduced odour or pungency.

German chemist Theodor Wertheim (1844) attributed garlic's appeal "mainly to the presence of a sulphur-containing, liquid body" (as quoted in Block, 1985, p. 115). Garlic is chemically complex containing an assortment of sulphur compounds depending on whether the cloves are intact, crushed, cooked or raw (Block, 1985). Macpherson and colleagues reported that raw (but not baked) garlic activates two temperature-activated ion channels that belong to the transient receptor potential (TRP) family, namely TRPA1 and TRPV1. These thermoTRPs are present in the pain-sensing neurons that innervate the mouth. Bautista et al. (2005) have identified the role of the TRPA1 channel in detecting the pungency of the chemically unstable allicin that is found in fresh garlic (Macpherson et al., 2005). Allicin, an unstable component of fresh garlic, is the chemical responsible for TRPA1 and TRPV1 activation and is therefore likely to cause garlic's pungency.[23]

Fresh-cut garlic and allicin, one of its constituents, activate TRPA1 and TRPV1, two noxious thermoTRPs found in pain-sensing neurons that innervate the mouth and tongue (see Jordt et al., 2003). This provides a biological mechanism through which garlic produces the "burning" sensations occur. Activation by garlic and allicin is specific to neurons expressing these channels; that is, no other populations of DRG or trigeminal ganglia neurons are activated by these stimuli. Allicin is by far the most potent activator of TRPA1 and TRPV1. Furthermore, the activity of allicin, given its concentration in garlic, is sufficient to explain all of garlic extract's activity on these thermoTRPs. By contrast, baked garlic (which lacks allicin) does not activate the thermoTRPs. Although allicin and other chemical components of garlic likely activate olfactory and gustatory neurons as well, the burning sensation caused by fresh garlic works through the trigeminal system. There may also be an impact of the odour of garlic by itself (Sattayakhom, et al., 2021).

10. Conclusions

Garlic, onions, leeks, chives and other members of the genus Allium have long been used both as edible plants and herbal medicines, and their use/appreciation dates back to the dawn of civilization (Block, 2009). The love/hate relationship with garlic in Britain (and also in many other English-speaking countries, such as Australia and North

[21] This fact presumably means that the garlic grown in Britain would have been stronger/more pungent than that grown in the warmer Mediterranean, perhaps helping to explain why the British may have been more reticent to eat this allium.

[22] In terms of pairing garlic-forward dishes with wine, the recommendation would appear to be something citrusy and acidic (i.e., preferably a white wine; e.g., see Chartier, 2012; Coucquyt et al., 2020; see also McGee, 2004).

[23] Most of the thermoTRP channels (including TRPV1 and TRPA1) are expressed in the sensory neurons of the dorsal root ganglia (DRG) adjacent to the spinal column, as well as in the trigeminal ganglia in the head.

America; see Hasler, 1998; Parker, 2004) has waxed and waned over the years. While a century or two ago, garlic was perceived as pungent and unpleasant (and rarely appeared in English cookbooks; Acton, 1845; Evelyn, 1699; Kitchiner, 1817), over the last 60 years or so, it has become an increasingly ubiquitous ingredient in English food, with the average Brit now apparently using half a clove per day, with 40% of those surveyed a couple of years ago wanting to put the pungent ingredient in all their meals (Hearn, 2021). It is difficult to determine whether the availability of different garlic cultivars in Britain may have resulted in people being exposed to less pungent varietals nowadays than was the case previously. As such, it remains uncertain to what extent people's tastes (i.e., preferences) have changed as the years have gone by versus today's commercial *alliums* simply being less pungent (see also Beato et al., 2011). However, the most plausible conclusion must be that shorter-term changes in popularity must be a matter of taste (and smell).

Implications for gastronomy

Garlic has long been a most divisive culinary ingredient, seemingly loved as much for the flavour it imparts as loathed for the sulphurous breath of those who have consumed it. In Britain, the culinary use of garlic has come into and fallen out of fashion repeatedly as the centuries have gone by. While hardly used in recipes after the Second World War, it has seen a major renaissance of interest in recent years. This can perhaps be traced back to the hugely popular writings on Mediterranean cuisine by the English cook, Elizabeth David in the UK in the 1950s. Sales of garlic continue to rise, year-on-year, with surveys suggesting that 40% of the British population would like to see this pungent herb in all of their meals. Indeed, it has been estimated that the average Brit consumes an average of half a clove of garlic each and every day. Given the growing popularity of this allium, chefs would be well advised to incorporate the healthy herb into their cuisine.

Declaration of competing interest

The author confirms that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. The manuscript has been read and approved by the author and there are no other persons who satisfied the criteria for authorship but are not listed. The Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office).

Data availability

No data was used for the research described in the article.

References

Acton, E., 1845. Modern Cookery for Private Families. Longmans & Co, London, UK.

Ahmad, J.I., 1996. Garlic—a panacea for health and good taste? Nutrion and Food Science 96, 32–35.

Amagase, H., Petesch, B., Matsuura, H., Kasuga, S., Itakura, Y., 2001. Intake of garlic and its bioactive components. J. Nutr. 131 (3s), 955S–962S. https://doi.org/10.1093/jn/131.3.955S.

Ankri, S., Mirelman, D., 1999. Antimicrobial properties of allicin from garlic. Microb. Infect. 1 (2), 125–129. https://doi.org/10.1016/s1286-4579(99)80003-3.

Apicius, 1936. In: Vehling, J.D. (Ed.), *Cooking And Dining in Imperial Rome (c.* 1st Century), Trans. by. University of Chicago Press, Chicago, IL.

Arora, D.S., Kaur, J., 1999. Antimicrobial activity of spices. Int. J. Antimicrob. Agents 12 (3), 257–262. https://doi.org/10.1016/s0924-8579(99)00074-6.

Arzanlou, M., Bohlooli, S., 2010. Introducing of green garlic plant as a new source of allicin. Food Chem. 120, 179–183. https://doi.org/10.1016/j.foodchem.2009.10.004.

Atif, M.J., Amin, B., Ghani, M.I., Hayat, S., Ali, M., Zhang, Y., Cheng, Z., 2019. Influence of different photoperiod and temperature regimes on growth and bulb quality of garlic (*Allium sativum* L.) cultivars. Agronomy 9, 879. https://doi.org/10.3390/agronomy9120879.

Attar, D., 1991. Keeping up appearances: the genteel art of dining in middle-class Victorian Britain. In: Wilson, C.A. (Ed.), *The Appetite and the Eye: Visual Aspects of Food and its Presentation within Their Historic Context* (Second Leeds Symposium on Food History and Traditions, April 1987, with Additional Papers). Edinburgh University Press, Edinburgh, pp. 123–140.

Ballou, M.M., 1897. Gleason's Pictorial Drawing Room Companion.

Banerjee, S.K., Maulik, S.K., 2002. Effect of garlic on cardiovascular disorders: a review. Nutr. J. 1, 4. https://doi.org/10.1186/1475-2891-1-4.

Barham, P., Skibsted, L.H., Bredie, W.L.P., Bom Frøst, M., Møller, P., Risbo, J., Snitkjær, P., Mortensen, L.M., 2010. Molecular gastronomy: a new emerging scientific discipline. Chem. Rev. 110 (4), 2313–2365. https://doi.org/10.1021/cr900105w.

Barnott-Clement, D., 2021. Black Garlic Adds 'sweet, Gorgeous' Flavour to Beer, Chocolate — and Ice Cream. ABC News. August 12th. https://www.abc.net.au/news/2021-08-13/black-garlic-in-beer-chocolate-and-ice-cream/100367190.

Bautista, D.M., Movahed, P., Hinman, A., Axelsson, H.E., Sterner, O., Högestätt, E.D., Julius, D., Jordt, S.-E., Zygmunt, P.M., 2005. Pungent products from garlic activate the sensory ion channel TRPA1. Proc. Natl. Acad. Sci. USA 102 (34), 12248–12252. https://doi.org/10.1073/pnas.0505356102.

Beato, V.M., Orgaz, F., Mansilla, F., Montaño, A., 2011. Changes in phenolic compounds in garlic (*Allium sativum* L.) owing to the cultivar and location of growth. Plant Foods Hum. Nutr. (Dordr.) 66 (3), 218–223. https://doi.org/10.1007/s11130-011-0236-2.

Beeton, I., 1861. Beeton's Book of Household Management. Ward, Lock, & Co, London, UK.

Benke, A.P., Khar, A., Mahajan, V., Gupta, A., Singh, M., 2020. Study on dispersion of genetic variation among Indian garlic ecotypes using agro morphological traits. Indian Journal of Genetics 80 (1), 94–102.

Benke, A.P., Krishna, R., Mahajan, V., Ansari, W.A., Gupta, A.J., Khar, A., Shelke, P., Thangasamy, A., Shabeer, T.P.A., Singh, M., Bhagat, K.P., Manjunathagowda, D.C., 2021. Genetic diversity of Indian garlic core germplasm using agrobiochemical traits and SRAP markers. Saudi J. Biol. Sci. 28 (8), 4833–4844. https://doi.org/10.1016/j.sjbs.2021.05.013.

Bickham, T., 2008. Eating the empire: intersections of food, cookery and imperialism in eighteenth century Britain. Past Present 198, 71–109. https://www.jstor.org/stable/25096701.

Billing, J., Sherman, P.W., 1998. Antimicrobial functions of spices: why some like it hot. QRB (Q. Rev. Biol.) 73 (1), 3–49. https://doi.org/10.1086/420058.

Block, E., 1985. The chemistry of garlic and onions. Sci. Am. 252 (3), 94–99. https://doi.org/10.1038/scientificamerican0385-114.

Block, E., 1986. Antithrombotic agent of garlic: a lesson from 5000 years of folk medicine. In: Steiner, R.P. (Ed.), Folk Medicine, the Art and the Science. American Chemical Society, Washington, DC, pp. 125–137.

Block, E., 1998. Garlic as a functional food: a status report. In: Shibamoto, T., Terao, J., Qsawa, T. (Eds.), Functional Foods for Disease Prevention, vol. 2. American Chemical Society, Washington DC, pp. 125–143.

Block, E., 2009. Garlic and Other Alliums: the Lore and the Science. Royal Society of Chemistry, London, UK.

Bonnici, T., 2012. Pouting Posh is a pain in Spain. Standard. **April 13th**. https://www.standard.co.uk/hp/front/pouting-posh-is-a-pain-in-spain-6951083.html.

Borlinghaus, J., Albrecht, F., Gruhlke, M.C.H., Nwachukwu, I.D., Slusarenko, A.J., 2014. Allicin: chemistry and biological properties. Molecules 19, 12591–12618. https://doi.org/10.3390/molecules190812591.

Bradley, M. (Ed.), 2015. Smell and the Ancient Senses. Routledge, London, UK.

Brar, P.S., Gill, S.P.S., Sandhu, K.S., 1994. Studies on the physico-chemical characteristics of selected varieties of garlic. Haryana J. Hortic. Sci. 23 (2), 173–176.

Brodnitz, M.H., Pascale, J.V., Van Derslice, L., 1971. Flavor components of garlic extract. J. Agric. Food Chem. 19, 237–245. https://doi.org/10.1021/jf60174a007.

Bromham, L., Skeels, A., Schneemann, H., Dinnage, R., Hua, X., 2021. There is little evidence that spicy food in hot countries is an adaptation to reducing infection risk. Nat. Human Behav. 5, 878–891. https://doi.org/10.1038/s41562-020-01039-8.

Bulliqi, E., 2018. Post-Gourmand: the Future of Sweetness. Perfumer & Flavorist. **May 4th**. https://www.perfumerflavorist.com/fragrance/fine-fragrance/article/21856719/postgourmand-the-future-of-sweetness.

Bush, R., 2020. From garlic to Marmite: British food through the centuries. Medium. **September 13th**. https://medium.com/weeds-wildflowers/from-garlic-to-marmite-8b3a486024b8.

Butt, M.S., Sultan, M.T., Butt, M.S., Iqbal, J., 2009. Garlic; nature's protection against physiological threats. Crit. Rev. Food Sci. Nutr. 49 (6), 538–551. https://doi.org/10.1080/10408390802145344.

Carter, M., 2011. All Things Bright and Edible: Fancy Some Black Garlic, Blue Potatoes or Red Cake? *the Independent*. **April 21st**. http://www.independent.co.uk/life-style/food-and-drink/features/all-things-bright-and-edible-fancy-some-black-garlic-blue-potatoes-or-red-cake-2270564.html.

Castada, H.Z., Mirondo, R., Sigurdson, G.T., Giusti, M.M., Barringer, S., 2017. Deodorization of garlic odor by spearmint, peppermint, and chocolate mint leaves and rosmarinic acid. LWT 84, 160–167.

Cervantes, M., 1605. Don Quixote. Penguin Classics.

Chartier, F., 2012. Taste Buds and Molecules: the Art and Science of Food, Wine, and Flavor. John Wiley and Sons, Hoboken, NJ (translated by Levi Reiss).

Chen, S., Shen, X., Cheng, S., Li, P., Du, J., Chang, Y., Meng, H., 2013. Evaluation of garlic cultivars for polyphenolic content and antioxidant properties. PLoS One 8 (11), e79730. https://doi.org/10.1371/journal.pone.0079730.

Clark, L., 2015. How Halitosis Became a Medical Condition with a "Cure". *The Smithsonian Magazine*, **January 29th**. https://www.smithsonianmag.com/smart-news/marketing-campaign-invented-halitosis-180954082/.

Clark, N., 2022. The Enduring Appeal of 'Allo 'Allo! *the Spectator*. **December 3rd**. https://www.spectator.co.uk/article/the-enduring-appeal-of-allo-allo/.
Classen, C., Howes, D., Synnott, A., 1994. Aroma: the Cultural History of Smell. Routledge, London, UK.
Clements, A., 2015. Divine scents and presence. In: Bradley, M. (Ed.), Smell and the Ancient Senses. Routledge, London, UK, pp. 46–59.
Cline, J.A., 1943. The variety meats. Practical Home Economics 21 (February), 57–58.
Collectif, 1964. Against vampires. *Encyclopedie du Monde Vegetal*. Quillet, Paris, France.
Colquhoun, K., 2007. Taste: the Story of Britain through its Cooking. Bloomsbury, London, UK.
Corbin, A., 1986. The Foul and the Fragrant: Odor and the French Social Imagination. Harvard University Press, Cambridge, MA.
Corzo-Martínez, M., Corzo, N., Villamiel, M., 2007. Biological properties of onions and garlic. Trends Food Sci. Technol. 18 (12), 609–625. https://doi.org/10.1016/j.tifs.2007.07.011.
Coucquyt, P., Lahousse, B., Langenbick, J., 2020. The Art & Science of Foodpairing: 10,000 Flavour Matches that Will Transform the Way You Eat. Richmond Hill. Firefly Books, ON.
Crawford, H.E.W., 1973. Mesopotamia's invisible exports in the third millennium B.C. World Archaeol. 5, 232–241. https://doi.org/10.1080/00438243.1973.9979570.
Critten, R.G., Kern-Stähler, A., 2016. Smell in the York corpus christi plays. In: Kern-Stähler, A., Busse, B., de Boer, W. (Eds.), The Five Senses in Medieval and Early Modern England. Brill, Leiden, NL, pp. 239–268.
Crocker, E.C., 1945. Flavor, first ed. McGraw-Hill Book Company, London, UK.
David, E., 1950. A Book of Mediterranean Food. John Lehmann, London, UK.
David, E., 1955. Summer Cooking. Penguin, London, UK.
David, E., 1962. French Provincial Cooking. Penguin, London, UK.
David, E., 1987. Italian Food. Barrie & Jenkins, London, UK.
Davies, M., 2023. Lockdown Gave Us Thyme to Spice up Our Cooking. The Times, p. 3. **March 31st**.
de Candóle, A., 1908. Origin of Cultivated Plants. D. Appleton and Company, New York, NY.
Deighton, L., 1965. Où est le garlic: French cooking in 50 lessons. Penguin, London, UK.
Draycott, J., 2015. Smelling trees, flowers and herbs in the ancient world. In: Bradley, M. (Ed.), Smell and the Ancient Senses. Routledge, London, UK, pp. 60–73.
Dubick, M., 1986. Historical perspectives on the use of herbal preparations to promote health. J. Nutr. 116 (7), 1348–1354. https://doi.org/10.1093/jn/116.7.1348.
Duckworth, G. (Ed.), 1942. *The Complete Roman Drama* (2 vols.). Random House, New York, NY.
Dunn, R., Sanchez, M., 2021. Delicious: the Evolution of Flavour and How it Made Us Human. Princeton University Press, Oxford, UK.
Dyer, C., 1999. Everyday Life in Medieval England. Hambledon Press, London, UK.
Ekşi, G., Özkan, A.M.G., Koyuncu, M., 2020. Garlic and onions: an eastern tale. J. Ethnopharmacol. 253, 112675 https://doi.org/10.1016/j.jep.2020.112675.
Ellis, C., 2007. *Fabulous Fanny Cradock*. Stroud. Sutton Publishing.
Eriksson, N., Wu, S., Do, C.B., Kiefer, A.K., Tung, J.Y., Mountain, J.L., Hinds, D.A., Francke, U., 2012. A genetic variant near olfactory receptor genes influences cilantro preference. Flavour 1, 22. https://doi.org/10.1186/2044-7248-1-22.
Evelyn, J., 1699. In: Driver, C. (Ed.), Acetaria: A Discourse of Sallets. Facsimile ed. Prospect, Totnes, 1996.
Fanaei, H., Narouirad, M., Farzanjo, M., Ghasemi, M., 2014. Evaluation of yield and some agronomical traits in garlic genotypes (*Allium sativum* L). Annual Research & Review in Biology 4 (22), 3386–3391. https://doi.org/10.9734/ARRB/2014/9090.
Fenwick, G.R., Hanley, A.B., 1985a. The genus Allium—Part 1. CRC Crit. Rev. Food Sci. Nutr. 22 (3), 199–270. https://doi.org/10.1080/10408398509527415.
Fenwick, G.R., Hanley, A.B., 1985b. The genus Allium—Part 3. CRC Crit. Rev. Food Sci. Nutr. 23 (1), 1–74. https://doi.org/10.1080/10408398509527419.
Ford, R., 1846. Gatherings from Spain. John Murray, London, UK.
Fretwell, E., 2020. Sensory Experiments: Psychophysics, Race, and the Aesthetics of Feeling. Duke University Press, London, UK.
Friesen, N., Fritsch, R., Blattner, F., 2006. Phylogeny and new intrageneric classification of *allium* (Alliaceae) based on nuclear ribosomal DNA ITS sequences. Aliso 22, 372–395. https://doi.org/10.5642/aliso.20062201.31.
Fritsch, R.M., Friesen, N., 2002. Evolution, domestication and taxonomy. In: Rabinowitch, H.D., Currah, L. (Eds.), Allium Crop Science: Recent Advances. CABI, Wallingford, Oxfordshire, pp. 5–30. https://doi.org/10.1079/9780851995106.0005.
Garlic Production in 2020, 2022. Crops/world regions/production quantity. In: Food and Agriculture Organization of the United Nations, Statistics Division (FAOSTAT).
Glasse, H., 1747. The Art of Cookery Made Plain and Easy. L. Wangford, Dublin, Ireland.
González, R.E., Soto, V.C., Sance, M.M., Camargo, A.B., Galmarini, C.R., 2009. Variability of solids, organosulfur compounds, pungency and health-enhancing traits in garlic (*Allium sativum* L.) cultivars belonging to different ecophysiological groups. J. Agric. Food Chem. 57 (21), 10282–10288. https://doi.org/10.1021/jf9018189.
'Guidance: School food standards practical guide', 2022. Updated May 11th. UK Government, Department of Education. https://www.gov.uk/government/publications/school-food-standards-resources-for-schools/school-food-standards-practical-guide.
Halliwell, B., Gutteridge, J.M.C., Cross, C.E., 1992. Free radicals, antioxidants and human disease: where are we now? J. Lab. Clin. Med. 119 (6), 598–620. PMID: 1593209.
Hanelt, P., 1990. Taxonomy, evolution, and history. In: Rabinowitch, H.D., Brewster, J.L. (Eds.), Onions and Allied Crops. CRC Press, Boca Raton, FL, pp. 1–26.
Hasler, C.M., 1998. Functional foods: their role in disease prevention and health promotion. Food Technol. 52, 63–70.
Hasler, C.M., 2002. Functional foods: benefits, concerns and challenges—a position paper from the American Council on Science and Health. J. Nutr. 132 (12), 3772–3781. https://doi.org/10.1093/jn/132.12.3772.
Hazlitt, W.C., 1902. In: Wheatley, H.B. (Ed.), Old Cookery Books and Ancient Cuisine, Popular edition. Elliot Stock, London, UK.
Hearn, A., 2021. National garlic day poll reveals average Brit uses half a clove every day. Mirror. **April 18th**. https://www.mirror.co.uk/news/uk-news/national-garlic-day-poll-reveals-23935614.
Hepper, P.G., 1988. Adaptive fetal learning. Prenatal exposure to garlic affects postnatal preferences. Anim. Behav. 36 (3), 935–936. https://doi.org/10.1016/S0003-3472(88)80177-5.
Herz, R., 2007. The Scent of Desire: Discovering Our Enigmatic Sense of Smell. William Morrow, New York, NY.
Hirsch, A.R., 1999. Garlic therapy. Harper's Mag. 298 (1788), 32. https://harpers.org/archive/1999/05/garlic-therapy/.
Hirsch, A.R., 2000. Effects of garlic bread on family interaction. Psychosom. Med. 62 (1), 607–608.
Hobbs, C., 1992. Garlic–the pungent panacea. Pharm. Hist. 34 (3), 152–157.
Hoffer, P.C., 2005. Sensory Worlds in Early America. John Hopkins University Press, Baltimore, Maryland.
Hughes, B.G., Lawson, L., 1991. Antimicrobial effects of *Allium sativum* L. (garlic), *Allium ampeloprasum* L. (elephant garlic), and *Allium cepa* L. (onion), garlic compounds and commercial garlic supplement products. Phytother Res. 5 (4), 154–158. https://doi.org/10.1002/ptr.2650050403.
Iranshahy, M., Iranshahi, M., 2011. Traditional uses, phytochemistry and pharmacology of asafoetida (*Ferula assa-foetida* oleo-gum-resin)—a review. J. Ethnopharmacol. 134, 110.
Jay, M., 2016. The ancient *Allium*. In: Onion and Garlic. A Global History. Reaktion Books, pp. 16–31.
Jervis, B., Craig-Atkins, E., Whelan, F., Madgwick, R., 2016. Pepper, pig and fewer bodily emissions – how the Norman Conquest changed England's eating habits. The Conversation. **October 14th**. https://theconversation.com/pepper-pig-and-fewer-bodily-emissions-how-the-norman-conquest-changed-englands-eating-habits-67000.
Jones, C., 2022. How to Harness the Healing Power of Garlic: It's Good for Blood Pressure and May Fight Colds. But what about the Odour? and How Much Do You Need? *Daily Mail Online*, **November 15th**. https://www.dailymail.co.uk/health/article-11428433/How-harness-healing-power-garlic-good-blood-pressure-fight-colds.html.
Jones, F.A., 1996. Herbs – useful plants. Their role in history and today. Eur. J. Gastroenterol. Hepatol. 8 (12), 1227–1231. https://doi.org/10.1177/014107689608901219.
Jordt, S.E., McKemy, D.D., Julius, D., 2003. Lessons from peppers and peppermint: the molecular logic of thermosensation. Curr. Opin. Neurobiol. 13 (4), 487–492. https://doi.org/10.1016/s0959-4388(03)00101-6.
Justice, E., 1746. A voyage to Russia: describing the laws, manners, and customs, of that Great Empire, as governed at this present by that Excellent Princess the Czarina. In: Shewing the Beauty of Her Palace, the Grandeur of Her Courtiers, the Forms of Building at Petersburgh, and Other Places: with Several Entertaining Adventures that Happened in the Passage by Sea and Land, the second ed. G. Smith, London, UK. *To which is added, four letters, wrote by the author-when at Russia to a gentleman in London. Written and collected by Elizabeth Justice*.
Kahn, G., 1996. History of garlic. In: Koch, H.P., Lawson, L.D. (Eds.), Garlic: the Science and Therapeutic Application of Allium Sativum L. And Related Species. Williams and Wilkins, New York, NY, pp. 25–36.
Kamenetsky, R., London Shafir, I., Khassanov, F., et al., 2005. Diversity in fertility potential and organo-sulphur compounds among garlics from central Asia. Biodivers. Conserv. 14 (2), 281–295. https://doi.org/10.1007/s10531-004-5050-9.
Kanerva, L., Elsner, P., Wahlberg, J.E., Maibach, H.I., 2004. Condensed Handbook of Occupational Dermatology. Springer, Berlin, Germany.
Kaur, M., Barringer, S., 2023. Effect of yogurt and its components on the deodorization of raw and fried garlic volatiles. Molecules 28, 5714. https://doi.org/10.3390/molecules28155714.
Kettler, A., 2023. Dispersing the Devil's Stench: Shifting Perceptions of Sulfuric Miasma in Early Modern English Literatures. Paper presented at Uncommon Senses IV, Montreal, Canada. May 3rd-6th.
Khanum, F., Anilakumar, K.R., Viswanathan, K.R., 2004. Anticarcinogenic properties garlic: a review. Crit. Rev. Food Sci. Nutr. 44 (6), 479–488. https://doi.org/10.1080/10408690490886700.
Kim, J.S., Kang, O.J., Gweon, O.C., 2013. Comparison of phenolic acids and flavonoids in black garlic at different thermal processing steps. J. Funct.Foods 5 (1), 80–86. https://doi.org/10.1016/j.jff.2012.08.006.
Kitchiner, W., 1817. Apicius Redivivus or the Cook's Oracle. Samuel Bagster, London, UK.
Koloski-Ostrow, A.O., 2015. Roman urban smells: the archaeological evidence. In: Bradley, M. (Ed.), Smell and the Ancient Senses. Routledge, London, UK, pp. 90–109.
Laakso, I., Seppänen-Laakso, T., Hiltunen, R., Müller, B., Jansen, H., Knobloch, K., 1989. Volatile garlic odor components: gas phased and absorbed exhaled air analyses by headspace gas chromatography—mass spectrometry. Planta Med. 55 (3), 257–261. https://doi.org/10.1055/s-2006-961998.
Lafaille, R., Hiemstra, H., Themstra, H., 1990. The regimen of Salerno, a contemporary analysis of a medieval healthy life style program. Health Promot. Int. 5 (1), 57–74.
Lanzotti, V., 2006. The analysis of onion and garlic. J. Chromatogr. A 1112 (1–2), 3–22. https://doi.org/10.1016/j.chroma.2005.12.016.
Largey, G.P., Watson, D.R., 1972. The sociology of odors. Am. J. Sociol. 77 (6), 1021–1034. https://doi.org/10.1086/225257.

Lawless, S., 2020. Common Scents: How Parasite Puts Smell at the Heart of Class War. The Guardian. February 23rd. https://www.theguardian.com/film/2020/feb/13/parasite-smell-bong-joon-ho.
Leatham, X., 2023. Garlic breath can be fixed by eating natural yogurt thanks to its neutralising proteins, scientists say. *Daily Mail Online*, **September 24th**. https://www.dailymail.co.uk/sciencetech/article-12555787/Garlic-breath-natural-yogurt-scientists.html.
Lemery, L., 1702. Traite des alimwents [Treatise on foodstuffs]. [As cited in Muchembled (2021).
Leyel, C.F., 1925. *Green salads and fruit salads*. George Routledge & Sons, Ltd.
Liébault, J., 1582. *Trois Livres* [Three Books]. [As Cited in Muchembled (2021).
Loeper, M., Debray, C.B., 1921. Hypotensive effect of tincture of garlic. *Progress in Medicine*, **36**, 391-392. Comptes Rendus hebdom. Soc. Biol. 85, 160–161.
Londhe, V.P., Gavasane, A.T., Nipate, S.S., Bandawane, D.D., Chaudhari, P.D., 2011. Role of garlic (*Allium Sativum)* in various diseases: an overview. J. Pharmaceut. Res. Opin. 1 (4), 129–134.
Maas, R.P.P.W.M., Voets, P.J.G.M., 2014. The vampire in medical perspective: myth or malady? QJM: Int. J. Med. 107 (11), 945–946. https://doi.org/10.1093/qjmed/hcu159.
Macpherson, L., Geierstanger, B.H., Viswanath, V., Bandell, M., Eid, S.R., Hang, S.-W., Patapoutian, A., 2005. The pungency of garlic: activation of TRPA1 and TRPV1 in response to allicin. Curr. Biol. 15 (10), 929–934. https://doi.org/10.1016/j.cub.2005.04.018.
Mason, L., Brown, C., 2006. The Taste of Britain. HarperPress, London, UK.
Mauer, L., El-Sohemy, A., 2012. Prevalence of cilantro (*Coriandrum sativum*) disliking among different ethnocultural groups. Flavour 1, 8. https://doi.org/10.1186/2044-7248-1-8.
McGee, H., 2004. In: rev (Ed.), On Food and Cooking: the Science and Lore of the Kitchen. Scribner, New York, NY.
McGee, H., 2010. Cilantro haters, it's not your fault. N. Y. Times. April 13th. http://www.nytimes.com/2010/04/14/dining/14curious.html?_r=0.
Megaloudi, F., 2005. Wild and cultivated vegetables, herbs and spices in Greek antiquity (900 B.C. to 400 B.C.). Environ. Archaeol. 10 (1), 73–82. https://doi.org/10.1179/146141005790083858.
Mei, X., Wang, M.L., Xu, H.X., Pan, Y.X., Gao, C.Y., Han, N., Fu, M.Y., 1982. Garlic and gastric cancer I: the influence of garlic on the level of nitrate and nitrite in gastric juice. Acta Nutr. Sin. 4, 53–56.
Mennell, S., 1985. All Manners of Food: Eating and Taste in England and France from the Middle Ages to the Present. Basil Blackwell, Oxford, UK.
Meyer, A., 1998. The 1998 top 100 ® R&D survey. Food Process 58 (8), 32–40.
Milner, J.A., 1996. Garlic: its anticarcinogenic and antitumorigenic properties. Nutr. Rev. 54 (11 Pt 2), S82–S86. https://doi.org/10.1111/j.1753-4887.1996.tb03823.x.
Morley, N., 2015. Urban smells and Roman noses. In: Bradley, M. (Ed.), Smell and the Ancient Senses. Routledge, London, UK, pp. 110–119.
Moyers, S., 1996. Garlic in Health, History, and World Cuisine. Suncoast Press, Venice, FL.
Muchembled, R., 2021. Smells: A Cultural History of Odours in Early Modern Times. Polity Press, Cambridge, UK.
Mukherjee, D., 2017. The British Curry. *Blogpost*, **November 2nd**. https://www.historic-uk.com/CultureUK/The-British-Curry/.
Nagourney, R.A., 1998. Garlic: medicinal food or nutritious medicine? Journal of Medicine and Food 1 (1), 13–28. https://doi.org/10.1089/jmf.1998.1.13.
Natale, P.J., Camargo, A., Galmarini, C.R., 2005. Characterization of Argentine garlic cultivars by their pungency. Acta Hortic. 688, 313–316. https://doi.org/10.17660/ActaHortic.2005.688.45.
Nolan, S., 2013. The Heston effect? List of food trends moves away from the traditional and embraces the unusual. *Daily Mail Online,* **April 2nd**. https://www.dailymail.co.uk/news/article-2302999/The-Heston-effect-List-food-trends-moves-away-traditional-embraces-unusual.html.
Ohtsubo, Y., 2009. Adaptive ingredients against food spoilage in Japanese cuisine. Int. J. Food Sci. Nutr. 60, 677–687. https://doi.org/10.3109/09637480802033502.
Orwell, G., 1937. The Road to Wigan Pier. Victor Gollancz, London, UK.
Palazzolo, C.T., Ramirez, D., Locatelli, D.A., Manucha, W., Castro, C., Camargo, A., 2018. Bioaccessibility and permeability of bioactive compounds in raw and cooked garlic. J. Food Compos. Anal. 70, 49–53. https://doi.org/10.1016/j.jfca.2018.03.008.
Pangborn, R.M., Guinard, J.-X., Davis, R.G., 1988. Regional aroma preferences. Food Qual. Prefer. 1, 11–19. https://doi.org/10.1016/0950-3293(88)90003-1.
Pardo, J.E., Escribano, J., Gómez, R., Alvarruiz, A., 2007. Physical–chemical and sensory quality evaluation of garlic cultivars. J. Food Qual. 30 (5), 609–622. http://www.medsci.cn/sci/journal.asp?id=7cf93796.
Parker, C., 2023. Light a Candle for the Tasty Aroma of Fried Garlic. The Times, p. 21. February 17th. https://www.thetimes.co.uk/article/light-a-candle-for-the-tasty-aroma-of-fried-garlic-0c6k2th3s.
Parker, J., 2004. Culinary herbs. In: Salvin, S., Bourke, M., Byrne, T. (Eds.), The New Crop Industries Handbook. RIRDC Publication No, pp. 236–243. . 04/125 (Canberra: Rural Industries Research and Development Corporation).
Pasteur, L., 1858. Mémoire sur la fermentation appelle lactique. Annals de Chimie et Physique Series 52, 404–418.
Pegge, S., 1780. *The Forme Of Cury: A Roll Of Ancient English Cookery Compiled, about A.D. 1390*. Project Gutenberg. https://www.gutenberg.org/cache/epub/8102/pg8102.txt.
Petrovska, B.B., Cekovska, S., 2010. Extracts from the history and medical properties of garlic. Phcog. Rev. 4 (7), 106–110. PMC3249897.
Plunkett-Hogge, K., 2022. From London to Edinburgh, Thai food is taking Britain by storm: with a swathe of new openings across the country, Thai food has taken over. The Telegraph. **June 21st**. https://www.telegraph.co.uk/food-and-drink/features/london-edinburgh-thai-food-taking-britain-storm/.
Potter, D., 2015. The scent of Roman dining. In: Bradley, M. (Ed.), Smell and the Ancient Senses. Routledge, London, UK, pp. 120–132.
Rabinowitch, H.D., Brewster, J.L., 1990. Onion and allied crops. In: Rabinowitch, H.D., Brewster, J.L. (Eds.), Botany, Physiology and Genetics. CRC Press, Boca Raton, FL, pp. 1–26.
Rajan, T.V., Hein, M., Porte, P., Wikel, S., 2005. A double-blinded, placebo-controlled trial of garlic as a mosquito repellent: a preliminary study. Med. Vet. Entomol. 19 (1), 84–89. https://doi.org/10.1111/j.0269-283X.2005.00544.x.
Renoux, V., 2005. For the Love of Garlic: the Complete Guide to Garlic Cuisine. Square One Publishers, Garden City, NY.
Reuter, H.D., 1995. *Allium sativum* and *Allium ursinum*: Part 2 pharmacology and medicinal application. Phytomedicine 2 (1), 73–91. https://doi.org/10.1016/S0944-7113(11)80052-8.
Ried, K., 2020. Garlic lowers blood pressure in hypertensive subjects, improves arterial stiffness and gut microbiota: a review and meta-analysis. Exp. Ther. Med. 19, 1472–1478. https://doi.org/10.3892/etm.2019.8374.
Rivlin, R.S., 2001. Historical perspective on the use of garlic. J. Nutr. 131 (3), 951S–954S. https://doi.org/10.1093/jn/131.3.951S.
Rosin, S., Tuorila, H., 1992. Flavor potency of garlic, pepper and their combination in different dispersion media. Lebensm. Wiss. Technol. 25, 139–142.
Rosin, S., Tuorila, H., Uutela, A., 1992. Garlic: a sensory pleasure or a social nuisance? Appetite 19 (2), 133–143. https://doi.org/10.1016/0195-6663(92)90016-Y.
Ross, E., 2015. How Garlic Became the Undisputed King of the British Kitchen. The Guardian. April 20th. https://www.theguardian.com/lifeandstyle/wordofmouth/2015/apr/20/how-garlic-became-the-undisputed-king-of-the-british-kitchen.
Ross, Z.M., O'Gara, E.A., Hill, D.J., Sleightholme, H.V., Maslin, D.J., 2001. Antimicrobial properties of garlic oil against human enteric bacteria: evaluation of methodologies and comparisons with garlic oil sulfides and garlic powder. Appl. Environ. Microbiol. 67 (1), 475–480.
Roussos, A.P., Hirsch, A.R., 2014. Alliacious migraines. Headache 54 (2), 378–382. https://doi.org/10.1111/head.12091.
Sahebkar, A., Serban, C., Ursoniu, S., Banach, M., 2016. Effect of garlic on plasma lipoprotein(a) concentrations: a systematic review and meta-analysis of randomized controlled clinical trials. Nutrition 32 (1), 33–40. https://doi.org/10.1016/j.nut.2015.06.009.
Sandvik, H., Baerheim, A., 1994. Does garlic protect against vampires? An experimental study [Norwegian]. Tidsskrift for den Norske laegeforening: Tidsskrift for praktisk medicin, ny raekke 114 (30), 3583–3586.
Sattayakhom, A., Songsamoe, S., Yusakul, G., Kalarat, K., Matan, N., Koomhin, P., 2021. Effects of Thai local ingredient odorants, Litsea cubeba and garlic essential oils, on brainwaves and moods. Molecules 26 (10), 2939. https://doi.org/10.3390/molecules26102939.
Schivelbusch, W., 1993. Tastes of Paradise: A Social History of Spices, Stimulants, and Intoxicants. Vintage Books, New York, NY.
Schivelbusch, W., 2014. The Railway Journey: the Industrialization of Time and Space in the Nineteenth Century. University of California Press, Oakland, CA.
Schleidt, M., Neumann, P., Morishita, H., 1988. Pleasure and disgust: memories and associations of pleasant and unpleasant odours in Germany and Japan. Chem. Senses 13 (2), 279–293. https://doi.org/10.1093/chemse/13.2.279.
Segnit, N., 2010. The Flavour Thesaurus: Pairings, Recipes and Ideas for the Creative Cook. Bloomsbury, London, UK.
Sharp, O., Waseem, S., Wong, K.Y., 2018. A garlic burn. BMJ Case Reports. https://doi.org/10.1136/bcr-2018-226027.
Shemesh-Mayer, E., Kamenetsky, R., 2021. Traditional and novel approaches in garlic (*Allium sativum* L.) breeding. In: Al-Khayri, J.M., Jain, S.M., Johnson, D.V. (Eds.), Advances in Plant Breeding Strategies: Vegetable Crops. Volume 8: Bulbs, Roots and Tubers. Springer, Cham, Switzerland, pp. 3–49. https://doi.org/10.1007/978-3-030-66965-2_1.
Sherman, P.W., Billing, J., 1999. Darwinian gastronomy: why we use spices. Spices taste good because they are good for us. Bioscience 49, 453–463.
Sherman, P.W., Flaxman, S.M., 2001. Protecting ourselves from food. Am. Sci. 89 (2), 142–151. https://doi.org/10.1511/2001.18.730.
Sherman, P.W., Hash, G.A., 2001. Why vegetable recipes are not very spicy. Evol. Hum. Behav. 22 (3), 147–163. https://doi.org/10.1016/s1090-5138(00)00068-4.
Shusterman, R., 2016. Somaesthetics and the fine art of eating. In: Irvin, S. (Ed.), Body Aesthetics. Oxford Academic, Oxford, UK, pp. 261–280. https://doi.org/10.1093/acprof:oso/9780198716778.003.0015.
Singh, A., 2009. Delia effect has cinnamon sticks flying off the shelves. Dly. Telegr. December 3 (News), 3.
Singh, M.C., Tiwari, R.S., 1995. Yield and quality attributes of garlic (*Allium sativum* L.) genotypes. Haryana J. Hortic. Sci. 24 (1), 46–49.
Singh, V.K., Singh, D.K., 2008. Pharmacological effects of garlic (*Allium sativum* L.). ARBS Annu. Rev. Biomed. Sci. 10, 6–26. https://doi.org/10.5016/1806-8774.2008.v10p6.
Smith, S.H., 2007. Demystifying a change in taste: spices, space and social hierarchy in Europe: 1380-1750. Int. Hist. Rev. 29 (2), 237–257. https://doi.org/10.1080/07075332.2007.9641125.
Sokolov, R., 1975. A plant of ill repute. Nat. Hist. 2, 70–71.
Soyer, A., 1845. The Gastronomic Regenerator. Simpkin & Marshall, London, UK.
Soyer, A., 1849. The Modern Housewife or, Ménagère. Simpkin, Marshall & Co, London, UK.
Spence, C., 2017. Breakfast: the most important meal of the day? Int. J. Gastron. Food Sci. 8, 1–6. https://doi.org/10.1016/j.ijgfs.2017.01.003.

Spence, C., 2021a. Gastrophysics: the psychology of herbs and spices. In: McWilliams, M. (Ed.), Proceedings of the Oxford Symposium on Food and Cookery, 2020. Prospect Books, London, UK, pp. 11–40.
Spence, C., 2021b. Scent in the context of live performance. i-Perception 12 (1), 1–28. https://doi.org/10.1177/2041669520985537.
Spence, C., 2022. Open Wide. Class Magazine, Spring, pp. 50–51.
Spence, C., 2023. Are pineapples really delicious? The history of the pineapple's taste/flavour and the role of varietal and terroir. Int. J. Gastron. Food Sci. 31, 100682 https://doi.org/10.1016/j.ijgfs.2023.100682.
Spence, C., Spence, S., 2023. Weeds from the yard. Int. J. Gastron. Food Sci. 33, 100776 https://doi.org/10.1016/j.ijgfs.2023.100776.
Spence, C., Youssef, J., 2018. Assessing the long-term impact of the molecular gastronomy movement on haute cuisine. Int. J. Gastron. Food Sci. 14, 35–44. https://doi.org/10.1016/j.ijgfs.2018.10.001.
Spencer, C., 2003. British Food: an Extraordinary Thousand Years of History. Columbia University Press, New York, NY.
Stabler, S.N., Tejani, A.M., Huynh, F., Fowkes, C., 2012. Garlic for the prevention of cardiovascular morbidity and mortality in hypertensive patients. Cochrane Database Syst. Rev. 8 (8), CD007653. https://doi.org/10.1002/14651858.CD007653.pub2.
Steiner, J.E., 1974. Innate, discriminative human facial expressions to taste and smell stimulation. Ann. N. Y. Acad. Sci. 237, 229–233. https://doi.org/10.1111/j.1749-6632.1974.tb49858.x.
Steiner, J.E., 1979. Human facial expressions in response to taste and smell stimulation. Adv. Child Dev. Behav. 13, 257–295. https://doi.org/10.1016/s0065-2407(08)60349-3.
Straudal, E., 1992. Life of the Ancient Egyptians. University of Oklahoma Press, Norman.
Tackholm, V., Drar, M., 1954. Flora of Egypt. In: Allium in Ancient Egypt, vol. III. Cairo University Press, Cairo, Egypt.
Tannahill, R., 1973. Food in History. Stein and Day, New York, NY.
The odor of race, 1904. The New York Times. May 22nd, 6. https://www.nytimes.com/1904/05/22/archives/the-odor-of-race.html.
Time-Life, 1982. Variety Meats. Time-Life Books, Chicago, IL.
Totelin, L., 2015. Smell as sign and cure in ancient medicine. In: Bradley, M. (Ed.), Smell and the Ancient Senses. Routledge, London, UK, pp. 17–29.
Ueda, Y., Sakaguchi, M., Hirayama, K., Miyajima, R., Kimizuka, A., 1990. Characteristic flavour constituents in water extract of garlic. Agric. Biol. Chem. 54 (1), 163–169. https://doi.org/10.1080/00021369.1990.10869909.
Vavilov, N.I., 1951. The Origin, Variation, Immunity and Breeding of Cultivated Plants (Trans. K. S. Chester). Stechert-Hafner, New York, NY.
Vinson, J.A., Hao, Y., Su, X., Zubik, L., 1998. Phenol antioxidant quantity and quality in foods: vegetables. J. Agric. Food Chem. 46 (9), 3630–3634. https://doi.org/10.1021/jf980295o.
Wake, C.H.H., 1979. The changing patterns of Europe's pepper and spice imports, ca. 1400-1700. J. Eur. Econ. Hist. 8, 361–403.
Wansink, B., 2002. Changing eating habits on the home front: lost lessons from World War II research. J. Publ. Pol. Market. 21 (Spring), 90–99.
Waters, W.G., 1997. *The Cook's Decameron*: A Study in Taste, Containing over Two Hundred Recipes for Italian Dishes. https://www.gutenberg.org/ebooks/930.
Weiss, A.S., 2002. Feast and Folly: Cuisine, Intoxication and the Poetics of the Sublime. State University of New York Press, Albany, NY.
Williams, R.F., 1835. Mephistophiles in England, or, the Confessions of a Prime Minister. Longman. & Longman, Rees, Orme, Brown, Green.
Witczak, K.T., 2006. The Hittite name for 'garlic.'. Acta Orient. Acad. Sci. Hung. 59 (3), 341–345. https://doi.org/10.1556/aorient.59.2006.3.4.
Xiong, X.J., Wang, P.Q., Li, S.J., Li, X.K., Zhang, Y.Q., Wang, J., 2015. *Garlic* for hypertension: a systematic review and meta-analysis of randomized controlled trials. Phytomedicine 22, 352–361. https://doi.org/10.1016/j.phymed.2014.12.013.
Yadav, S., Trivedi, N.A., Bhatt, J.D., 2015. Antimicrobial activity of fresh garlic juice: an in vitro study. Ayu 36 (2), 203–207. https://doi.org/10.4103/0974-8520.175548.
Zhao, R., 2015. A History of Food Culture in China (Trans. G. Wang & A. Y. Wang). SCPG Publishing Corporation, New York, NY.
Zhao, W.G., Chung, J.W., Lee, G.A., Ma, K.H., Kim, H.H., Kim, K.T., Chung, I.M., Lee, J. K., Kim, N.S., Kim, S.M., Park, Y.J., 2011. Molecular genetic diversity and population structure of a selected core set in garlic and its relatives using novel SSR markers. Plant Breed. 130 (1), 46–54. https://doi.org/10.1111/j.1439-0523.2010.01805.x.
Zheng, S.-J., Kamenetsky, R., Féréol, L., Barandiaran, X., Rabinowitch, H.D., Chovelon, V., Kik, C., 2007. Garlic breeding system innovations. Medicinal and Aromatic Plant Science and Biotechnology Medicinal and Aromatic Plant Science and Biotechnology 1 (1), 6–15.