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2 RUNNING HEAD: THE HISTORY OF EDIBLE FLOWERS

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5 **Looking to the future, by studying the history of edible flowers**

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ABSTRACT

14 Flowers have provided comfort to humans for millennia. Imbued with aesthetic value and
15 symbolic meaning, they have long been present in funeral rituals, feasts, offerings, and songs.
16 Carriers of aesthetic beauty, they are used as adornments in physical spaces, as decorations
17 through flower arrangements, as well as appearing in paintings, ceramics, perfumery and
18 fabrics. It is important to recognise the nutritional and gastronomic possibilities of flowers.
19 This historical review draws attention to the use of flowers in foods by highlighting their
20 versatility in different parts of the world and in a variety of culinary contexts. Although few
21 people would currently appear to consider flowers as edible, many flowers contain positive
22 bioactive (e.g., anti-oxidant health) properties; they are sometimes also nutritionally
23 beneficial. A few flowers have a pleasant taste/flavour, and a number of species provide an
24 effective and natural means of enhancing the eye-appeal of a dish (such as when used in
25 salads) as far as ‘gastroporn’ is considered. In fact, a closer analysis reveals that different
26 flowers can be used to effectively stimulate/engage many of the consumer’s senses. In this
27 narrative historical review, the literature documenting the deliberate incorporation of flowers
28 in the context of food and drink are reviewed. By highlighting some of the gastronomic
29 possibilities associated with edible flowers as well as drawing attention to their frequent use
30 in a historical context, the hope is that it may be possible to nudge more consumers to
31 reconsider this ubiquitous, but currently largely untapped, food resource. Innovative chefs
32 may be in the best position to help change the attitudes of consumers, given than most people
33 currently do not seem to consider/categorize flowers as an edible resource.

34 **KEYWORDS:** FLOWERS; GASTROPHYSICS; TASTE; FLAVOUR, HISTORY.

35 **1. Introduction**

36 Archaeological findings at the Raqefet Cave indicate that 13,700–11,700 years ago, the
 37 Natufians lined their graves with fresh flowering plants, in an orderly manner, thereby
 38 providing the dead with both colour and fragrance.¹ Currently, this stands as perhaps the
 39 earliest documented evidence of flower-lined graves in the Mount Carmel territory in Israel,
 40 and in history more generally (Nadel et al., 2013). It serves to alert us to the importance of
 41 flowers, which have been imbued with both symbolic and social meaning since the earliest
 42 times of human history. Indeed, flowers are powerful, and are capable of provoking a wide
 43 range of responses, ranging all the way from eliciting a smile through to triggering episodic
 44 memories (e.g., Haviland-Jones, Rosario, Wilson, & McGuire, 2005).² Flowers have been
 45 demonstrated to influence people’s well-being, comfort, pain tolerance, restorative condition,
 46 and health (Guarrera & Savo, 2013; Park, Mattson, & Kim, 2002; Park & Mattson, 2009; see
 47 Spence, 2021, for a review). It often feels as though one can see flowers wherever one looks:
 48 we are used to seeing flowers in gardens, in paintings, on our dining tables, and we may even
 49 touch them. We also smell their natural scent; we may also smell their synthetic counterpart
 50 when someone crosses before us wearing a perfume with floral notes or when nosing a glass
 51 of wine (Suárez-Diego et al., 2023; Wang & Spence, 2019). We listen to people singing
 52 about them in such a variety of songs in the most diverse of styles – in operas, such as
 53 “Lakmé” with “The flower duet” song (Delibes, 1890); in popular war songs such as “Roses
 54 of Picardy” by Frederick E. Weatherly and Haydn Wood; in films as “The Sound of Music”
 55 with the song “Edelweiss” (*Leontopodium nivale*) (Pet’ko & Ostapchuk, 2020); in country
 56 songs such as “Yellow Roses” from Dolly Parton, as well as in rock (e.g., “Marigold” –

1 ¹ One set of impressions was identified as the flowering stems of *Salvia judaica* Boiss. (Judean sage), and the
 2 closely related species of the mint family (*Labiatae*) or to the figwort family (*Scrophulariaceae*; Nadel et al.,
 3 2013).

4 ² It is also interesting to consider the importance of the fact that there is central nervous system processing of
 5 floral odour and the odour of mother’s milk in infants (Gellrich et. al., 2021).

57 Nirvana; “Bed of roses” – Bon Jovi) and pop music (e.g., “Flowers” – Miley Cyrus,
 58 “Daisies” – Katy Perry, “Supermarket flowers”– Ed Sheeran; see also Davies & Saunders,
 59 2012, p. 111). We can also taste flowers; indeed, flowers have the power to engage all of our
 60 senses.

61 The market for edible flowers has grown markedly in recent years (Acikgoz, 2017), and is
 62 predicted to grow even further in the years ahead (e.g., see Edible Flowers Market: Forecast,
 63 Trend Analysis & Competition Tracking - Global Market Insights 2018 to (2028)). It has
 64 been argued that, as humans, we have embodied aesthetic reactions to flowers (e.g., Hůla &
 65 Flegr, 2021; Huss, Yosef, & Zaccai, 2018; Ruiz-Hernández et al., 2021). However, while
 66 flowers have been consumed for centuries, often as a visually-attractive food source, they
 67 currently appear to serve primarily a decorative function. Potentially relevant here, it has
 68 been suggested that flowers have been selectively bred over recent centuries for their eye
 69 appeal (often at the cost of fragrance; see Classen, Howes, & Synnott, 1994). Interestingly,
 70 wild flowers, such as the *Arum palaestinum* (Solomon’s Lily), were also gathered (its parts)
 71 historically in the Holy Land not only for their visual or nutritional qualities, but also for their
 72 medicinal qualities. This plant, which need a special treatment during the preparation to
 73 eliminate its toxicity, was further considered as a cultivated crop, mentioned in the *Mishnah*,³
 74 where its cultivation and use as a source of food is described (Mayer-Chissick & Lev, 2014).

75 Currently though, people’s conceptual representations of flowers tend not to be food-related
 76 (see Rodrigues et al., 2017). In Brazil, for instance, edible flowers are categorised under an
 77 umbrella term “PANCs – *Plantas Alimentícias Não Convencionas*” (Eng: UFPs –
 78 Unconventional Food Plants) (Jacob & Albuquerque, 2021). Indeed, it would seem possible
 79 that the development of the fragrance/perfume industry may inadvertently have shifted

6 ³ Mishnah is the first major written collection of the Jewish oral traditions that are known as the Oral Torah,
 7 being also the first major work of rabbinic literature.

80 people's opinion from considering flowers as being edible to the fragrant element of many
81 Home and Personal Care (HPC) products and perfumes (see Herz Larsson et al., 2022;
82 Spence, 2020b, for reviews).⁴ Nowadays, of course, there is also a well-being angle to the use
83 of floral scents in the world of aromatherapy (Jo et al., 2013; Spence, 2002, 2020b). [Edible](#)
84 [flowers might sometimes be considered a marginal part of agriculture and cuisine, since some](#)
85 [people may associate their consumption with poverty, such as is reported to be the case in](#)
86 [Mexico \(Manzanero-Medina et al., 2020; Mulík & Ozuna, 2022\).](#)

87 It is interesting to stress that over the last ten years, a plethora of reviews has been published
88 on the topic of edible flowers, in different scientific journals and approaching the topic from a
89 diverse range of angles. For instance, authors have considered the benefits and risks
90 pertaining to the consumption of edible flowers (Matyjaszczyk & Śmiechowska, 2019);
91 chemical composition as part of balanced diet (Kandyliś, 2022; Pires et al., 2019);
92 nutraceutical, phytonutrients, toxicological, and health aspects (Fernandes et al., 2017; Lu et
93 al., 2016; Purohit et al., 2021; Rivas-Garcia et al., 2021; Skrajda-Brdak et al., 2020; Zheng et
94 al., 2021); post-harvest technologies (Fernandes et al., 2019) and preservation (Zhao et al.,
95 2019); use in food technology manufacturing (Takahashi et al., 2020); taste/flavour
96 (Benvenuti & Mazzoncini, 2021); traditional and cultural uses (Motti et al., 2022; Mulík &
97 Ozuna, 2020; Santos & Reis, 2021;) and marketing perspectives (Fernandes et al., 2020).
98 Furthermore, a recent study by Pieterse, Millan, and Schönfeldt (2023) reveals a nostalgic
99 connection of the flower with local culture and heritage and its unique taste and flavour are
100 key consumption drivers. Nevertheless, none of them have approached the topic of edible
101 flowers from a historical context.

8 ⁴ One should also consider the rise of gourmet perfumes (Herz et al., 2022), linking back to explicitly food-
9 related scents.

102 The aim of this narrative historical review is therefore to draw attention to the use of flowers
103 in cuisine throughout different historical periods, places, and contexts by highlighting the
104 versatility of flower employment in a variety of culinary contexts. When and where did the
105 consumption of edible flowers start? Did the consumption begin differently depending on the
106 country and period of history that is considered?

107

108 **2. Methodological approach**

109 As pointed out by Uria-Gonzalez and Garcia-Alvarez (2023), as any other sector of
110 historiography, the procedural research in food history has the same flow: First, the choice of
111 the subject, its justification and understanding that it responds to the social and scientific
112 demands of the community. Then, following the scientific method, a research question and/or
113 hypothesis might be elaborated, material is collected from a wide range of sources, and
114 description and analysis follow.

115 In the present narrative historical review (see Ferrari, 2015; Furley & Goldschmied, 2021, on
116 the benefits of narrative-style reviews), we approach “edible flowers” as our subject of
117 research. As seen previously, edible flowers have been approached in science, on a diversity
118 of ways. Nonetheless, no attention has been drawn to their place in history. We hope that a
119 narrative historical review of the consumption of edible flowers in different cultural and
120 temporal contexts, will help to highlight its culinary versatility, catapulting its application
121 into different culinary settings in the years ahead. In this review, we focus on a broad range
122 of mentions of (and evidence concerning) edible flowers throughout history. To do this, we
123 consulted a wide range of books (i.e., food history books, cookbooks, manuals, political
124 books, history and entertainment books), as well as scientific essays, anthropological and
125 expedition reports, leaflets, magazines, photography and paintings. Internet searches,

126 cooking shows, websites, and dedicated food podcasts were also used. The focus was the
 127 extraction of information about the type of flower as well as its time-place contextual
 128 consumption.

129

130 **3. Historical mentions of edible flowers**

131 Prehistoric remains indicate that flowers were consumed as part of the Palaeolithic Age diet
 132 (e.g., Challa, Bandlamudi, & Uppaluri, 2022). Ancient mythological Greek writings, such as
 133 *The Odyssey* by Homer, refers to a race of people “The Lotus-Eaters” (*in Greek: λωτοφάγοι*),
 134 who lived on an island where the lotus flowers were the primary source of food, and were
 135 also a narcotic, thus causing the inhabitants to sleep in peaceful apathy (Murtola, 2010).
 136 According to Beeton (1861), the ancient Greeks and Romans used flowers, along with herbs,
 137 roots, and vegetables to make pickles, which were kept, for a long time, in cylindrical vases,
 138 and were held in high esteem. Early reports indicate that in Ancient Rome, flowers such as
 139 violets and roses were used in dishes while lavender flowers were incorporated into sauces
 140 (Cunningham, 2015). Legend has it that in the rose feasts held by Nero, there would have
 141 been fountains of rose-water, the wine served at his banquets was flavoured with rose, and a
 142 rose pudding was usually to be found amongst the desserts (Skinner, 1913).⁵

143 In Iran, some flowers, such as roses and saffron, have been used in a culinary context for
 144 more than 3,000 years (Crossley, 2014). A rich source of information concerning the use of
 145 flowers as food, and the importance attached to their consumption worldwide, comes from

10 ⁵ Pliny complains about the extensive use of incense and spices during the funeral rites of Poppaea, Emperor
 11 Nero's consort, as well as the amount of money spent on buying these spices for use as perfumes by women (see
 12 Rackham, 1945): “... Arabia does not produce so large a quantity of perfume in a year's output as was burned
 13 by the Emperor Nero in one day at the obsequies [funeral rites] of his consort Poppaea...” (Pliny, Natural
 14 History XII.41). “The highest praise of a perfume is if a passing woman who is wearing it distracts men who are
 15 otherwise engaged. For this, people are prepared to pay more than 400 denarii a pound!” (Pliny, Natural History
 16 XIII.20). “And by the smallest computation India, China and that peninsula [Arabia] take 100 million sestertii
 17 from our empire every year – so much do our luxuries and our women cost us.” (Pliny, Natural History XII.41).

146 the religious mission fields and expeditions reports. In “Japan as a mission field” by
147 Reverend Worcester, the possibility of using flowers as food is mentioned directly on the
148 missionaries’ description of the landscape: “... *a land abounding in trees and flowers of*
149 *numerous varieties, and rich in productions useful for food, for man and beast*” (Worcester,
150 1879, p. 1). A note published in *The American Naturalist* (a scientific journal) in 1882, by
151 Professor Penhallow, draws attention to the cultivation of lilies in Japan of the 19th century as
152 an important crop: “*The Japanese hold the lily bulbs, as a source of farinaceous food, in*
153 *great esteem, and the demand for them is so great that they are cultivated (L. bulbiferium) in*
154 *large quantities and form one of the prominent farm products to be seen in the market The*
155 *bulbs are simply boiled and eaten as potatoes would be.*” (Penhallow, 1882, p. 119).
156 However, he argued how difficult it is to give testimony about the flavour and desirable
157 qualities of flowers and buds from various species of *Hemerocallis*. What makes Penhallow
158 so curious about the taste of lily flowers is their abundance at the time of blossoming and
159 how Japanese Aino women make use of this in their kitchen. “*When Aino women may be*
160 *seen busily engaged gathering the flowers which they take home and dry, or pickle in salt.*
161 *They are afterwards used in soups. I have been told that the Japanese make a similar use of*
162 *them, but probably only to a very limited extent.*” (Penhallow, 1882, p. 120). In the book
163 “The useful plants of the Island of Guam” (Safford, 1905), mention can be found on the use
164 of the flowers of the *leguminosae Agati grandiflora*, known by its popular name, as
165 “Katurai”, as a food source.

166 In the African continent, Khoisan hunter-gatherer and forager families, now extinct,
167 traditionally consumed *Aponogeton distachyos*, a wild-gathered plant that used to be a source
168 of food during the winter months providing carbohydrates, minerals, and vitamins (De
169 Vynck, Van Wyk & Cowling, 2016; Welcome & Van Wyk, 2019). According to Pieterse,

170 Millan and Schönfeldt (2023), it was introduced to the Dutch settlers in the 1700s, who used
 171 it in soups and stews as a vegetable.

172 Edible flowers seems to have been the inspiration for timeless fairy tales in Germany. The
 173 brothers Grimm “Rapunzel” it is an example. In this fairy tale, the wicked witch used the
 174 name of the plant that the little girl's father stole from her garden, as her name “Rapunzel”:
 175 ... *Through the small rear window of these people's house they could see into a fairy's garden*
 176 *that was filled with flowers and herbs of all kinds... One day the woman was standing at this*
 177 *window, and she saw the most beautiful rapunzel⁶ in a bed... "Oh, if I do not get some*
 178 *rapunzel from the garden behind our house, I shall surely die," she said. The man, who loved*
 179 *her dearly, decided to get her some, whatever the cost. She immediately made a salad from it,*
 180 *which she devoured greedily. It tasted so very good to her that by the next day her desire for*
 181 *more had grown threefold* (<https://sites.pitt.edu/~dash/grimm012a.html>).

182 Cookbooks from the time of the Brazilian Empire (1822-1889) highlight how various flowers
 183 were used in Brazilian kitchens: Orange blossom water in soups, sauces, and desserts (Lima,
 184 1887), *Myristica fragans* in “Veal with Sardines” (Cozinheiro Nacional, 1882; cf. Aki &
 185 Perosa, 2002, for the contemporary use of edible flowers in Brazilian cuisine). Perhaps the
 186 most diverse and extensive mentions of flowers can be found in the “*Manual do Distillador e*
 187 *Licorista*” – the old Portuguese for “Distiller and Liqueurist's Manual”: Water of a thousand
 188 flowers (containing attar of roses and oils of lavender, orange blossom and melissa flowers);
 189 Turkish water (tilia flowers tea - *Tilia tomentosa* – Angelica seeds); Angelica (lavender,
 190 orange blossom); American water (lavender); Alpes (orange blossom attar, violet root);

18 ⁶ The German word "Rapunzel" is defined variously, by different authors (e.g., Thompson, 1989). However,
 19 four edible flowering plants are frequently attributed as the original plant of the fairytale: "rampion bellflower
 20 (*Campanula rapunculus*)", "spiked rampion (*Phyteuna spicata*)", "German rampion (*Oenothera biennis*)" and
 21 "lamb's lettuce (*Valerianella locusta*)". It is also interesting to observe that with translations from German to
 22 other languages, the name “Rapunzel” – and its meaning related to the original flowering plant – shifted to other
 23 names and sometimes, other flowers, but not on an edible sense. This is the case of Grimm (1846), translated to
 24 English by John Edward Taylor, where he replaces “Rapunzel” by “Violet”, and rather than craving salad, the
 25 mother demands her own bouquet of the sweet-smelling violets that only grow in the fairy's garden.

191 Consoling balm (attar of *Reseda odorata*, rose, orange blossom, and jasmine); Chartreuse
 192 (nutmeg flower; *Hyssopus*); Cognac (lavender); Imperial cream (rose and orange blossom
 193 water); Rhum attar (violet attar); Ratafiá of Kernels (rose, orange blossom oil); Juniper
 194 Ratafia (nutmeg flower); Madeira wine (tilia flowers); Malaga wine (bastard saffron flower –
 195 *Carthamus tinctorius*) (Manual do distillador e licorista, 1883). In the United States, *The*
 196 *Unrivalled Cook-Book and Housekeeper's Guide* by Mrs. Washington (1886), disclose a
 197 variety of recipes using roses, rosemary, and violets (e.g., teas, preserves, cakes, jellies,
 198 biscuits, flavoured waters, creams and desserts, amongst many others).

199 Different species of edible flower are also mentioned in different editions of a large collection
 200 of import inventories, called the “*Inventory of Seeds and Plants Imported*” from the U.S.
 201 Department of Agriculture, from the opening years of the 20th century. The following
 202 interesting passage appears in the 1913 edition: “*It is to be hoped that somewhere in Florida*
 203 *amateurs can grow the curious ear flower of the Aztecs (No. 35039), used by them to flavor*
 204 *their chocolate perhaps centuries before the Spaniards landed in Mexico.* This refers to the
 205 *Cymbopetalum penduliflorum*, or the “sacred ear flower”, imported by the Americans from
 206 Guatemala. In this same edition, the author refers to other species of flowers such as
 207 *Borassus flabellifer* or Palmyra Palm, imported from India. *The sap obtained from the*
 208 *flower's spathes are either fermented for the obtention of a toxic drink or boiled down for*
 209 *making sugar or jaggery* (Inventory of Seeds and Plants Imported, 1913).⁷

210 An interesting document – “*Plantas silvestres comestibles catalogo*” / Eng. “Wild edible
 211 plants catalog” – from the Communist Republic of Cuba dating from 1987 contains a few
 212 mentions of edible flowers. Interestingly, this document was prepared (as declared in the
 213 introduction to the volume), in order to know which plants would be used in the case of a

26 ⁷ Jaggery is a traditional non-centrifugal cane sugar consumed in the Indian Subcontinent, Southeast Asia, and
 27 Africa.

214 food shortage, due to war, and was commissioned by Commander Fidel Castro himself.⁸
 215 Amongst the species cited are *Calendula officinalis* (edible petals used in soups) and *Yucca*
 216 *aloifolia* (flowers used in salads) (Colectivo de autores, 1987). A recent study by De Oca
 217 Vázquez (2021) which aimed to ascertain which unconventional plants have been consumed
 218 by the Cuban population, shows that calendula is also consumed in infusions and the
 219 “platanillo de Cuba” (*Piper* spp.) is consumed in salads.

220 Flowers were not only consumed in the Tropics, but also in the Arctic Circle. Anthropologists
 221 assumes that the ‘primitive’ peoples from the Arctic have probably always been carnivorous,
 222 securing food by hunting and fishing. Nevertheless, they may have observed polar bears and
 223 other animals eating grass and followed their lead, when other sources of food failed them
 224 (Porsild, 1953). According to Porsild, the Eskimo from Alaska ate flowering axes of marsh
 225 fleabane (*Senecio congestus*) and coltsfoot (*Petasites frigidus*), which were made into a form
 226 of “sauerkraut” mixed with blubber. In the southern parts of east and west Greenland, the
 227 *kvan* (*Angelica archangelica*) are the flowering stems and were considered a great delicacy in
 228 these times (Porsild, 1953). A 1909 guide leaflet from the American Museum of Natural
 229 History – “*Stokes Painting representing Greenland Eskimo*” provides a description of the
 230 mural decoration at the Northern end of the Eskimo Hall. Mr. Stokes (the painter of these
 231 murals) participated in the Peary North Greenland Expedition in 1893-1894, studying and
 232 documenting the way of life of Inuits (Greenlander natives). Flowers are mentioned in a
 233 description of his painting of the Reindeer Hunting in Summer (the Eskimo in the long arctic
 234 day): “*There are several plants of which the roots, leaves, buds, and even flowers are eaten...*
 235 *A plant resembling celery (Archangelica officinalis) is a favourite article of food* (James,
 236 1909, p. 13). The elegant blue violet arctic harebell (*Campanula rotundifolia*) – the emblem

28 ⁸ "...But in case the situation becomes very difficult regarding food, there are leaves of many plants and grasses
 29 that are edible... It is necessary to study the plants that make up the Cuban flora, to know which of them they
 30 can constitute food in time of war... Carry out a study, because those that are not toxic could serve us" (Head
 31 Commander Fidel Castro Ruz, Dic. 9/86, *durante Ejercicio Bastión 86*).

237 of Sweden – is eaten in Greenland during the short growing season. Other eaten wild flowers
 238 in Greenland are the flowering stems of roseroot (*Rhodiola rosea*) and the fernweeds⁹
 239 (*Pedicularis hirsuta* and *P. lunata*) eaten boiled; Broad-leaved willow-herb (*Epilobium*
 240 *latifolium*) was apparently occasionally eaten raw with seal blubber. By the end of the 20th
 241 century a book about edible flowers was published – “*Flower in the kitchen: A bouquet of*
 242 *tasty recipes*” (Belsinger, 1991). In this volume, the author discusses the use of flowers in
 243 cooking and how to grow edible flowers, and shares recipes for dishes using flowers, from
 244 the blossoms on common garden herbs to daylilies, marigolds, roses, and yucca. A note
 245 published by Associate Professor Kathleen M. Kelley, from Penn State College of
 246 Agricultural Sciences in 2002, states that *any edible flower cookbooks or references used for*
 247 *identification should have the following: Pictures of the flower/plant; Description of the*
 248 *flower/plant appearance; What portion of the flower/plant is edible; How the flower can be*
 249 *used; Scientific name (genus and species) for identification* (Kelley, 2002, p. 1).

250 It seems that the desire to eat flowers has been in people's imagination for a long time. The
 251 tradition of imitating flowers to decorate both sweet and savoury dishes reached its peak in
 252 the 20th century and has been reinventing itself in the 21st century. **Figure 1** shows the
 253 covers (1948 and 1958) of the luxurious American Gourmet magazine¹⁰, and a dish from El
 254 Celler de Can Roca, called “Macadamia rose, grapefruit, lychee and nose by Jordi Roca”. The
 255 illustration of the magazines' cover refers to the use of other food to imitate the shape of
 256 flowers (probably gelatina and tomato peel). In Jordi Roca's creation, the flower petals are
 257 made from macadamia nuts.

32 ⁹ According to Porsild (1953), Eskimo children pick the flowers and suck the sweet nectar from the base of the
 33 long corolla tube. This practice was also common in the past in the Faroe Islands, where Faroese children suck
 34 the sweet nectar from the flowers of *Vicia cracca* (Svanberg & Egisson, 2012).

35 ¹⁰ Gourmet (1941-2009), was a monthly cook and travel magazine by Condé Nast and the first American
 36 magazine devoted to food and wine. The New York Times noted that *Gourmet was to food what Vogue is to*
 37 *fashion* (<https://www.nytimes.com/2009/10/06/business/media/06gourmet.html>).

258 PLEASE INSERT FIGURE 1 AROUND HERE

259

260 *3.1. The history of edible flowers in Britain*

261 Flowers were prominently used as a source of food in Mediaeval England. A black and white
262 mural (see **Figure 2**) by designer David Gentleman covers the walls of the Northern line
263 platform of the Charing Cross tube station since the 1970s. It depicts, in comic book form,
264 scenes of English mediaeval life. The murals retell the story of the construction of the
265 eponymous cross, built in 13th century on the order of King Edward I as one of a number in
266 memory of his wife, Queen Eleanor of Castile. Flowers can be seen emerging from a bucket,
267 next to the scene of two women preparing something with the help of a sieve: Perhaps some
268 food for people or beasts. A popular dish at the time in England was known as *Vyolette*, and
269 consisted of the flowers, boiled, pressed, and brayed with additions of milk, rice flower, and
270 honey (Skinner, 1913). Meanwhile, Smith (2007) notes that powdered sugar was often
271 flavoured with a spice or aromatic flower. For instance, according to the historical record, in
272 1265, Eleanor, countess of Leicester, bought powdered sugar flavoured with mace, and
273 between 1284 and 1286, Bogo de Clare bought jars of rose and violet sugars (see also
274 Giuseppi, 1920; Turner, 1841).

275 PLEASE INSERT FIGURE 2 AROUND HERE

276 Meanwhile, for Richard III of England's coronation in 1483, 18lbs. of turnsole was needed
277 for a feast for around 1,000 people (see Sutton & Hammond, 1983). In fact, according to
278 Woolgar (2018), turnsole – so-called because the blue and white flowers turn their head
279 towards the sun – were often used in (courtly) mediaeval cuisine. Flowers would also seem to
280 have been an important part of the daily habits of other British sovereigns. For instance,

281 Queen Elizabeth I (1533-1603) used to drink lavender tea to fight her migraine headaches and
282 may have drunk as many as ten cups a day (Newman & Kirker, 2016). The book *The Queen's*
283 *Closet Opened* (W. M., 1658) contains an important collection of recipes originating from the
284 kitchen of Queen Henrietta Maria (1609-1669), the Queen consort and wife of King Charles
285 I. This may be seen as a watershed in modern Britain, in terms of the cataloguing of the use
286 of edible flowers and other ingredients. In this seminal volume, a huge collection of recipes
287 using a diverse palette of flowers (e.g., violets, roses, marigold, primroses, and so forth) both
288 as food and medicaments (cf. Amri, 2014) can be found.

289 In his book *Borough Market: Edible histories – epic tales of everyday ingredients* Mark
290 Riddaway mentions Britain's oldest recipe for ice-cream in which flowers are present, dated
291 1651-78, from a manuscript of the jottings of Lady Ann Fanshawe, wife of the English
292 ambassador to Spain: "*Three pints of the best cream boiled with mace, orange flower water*
293 *or ambergris, then sweetened with sugar*" (Riddaway, 2020, p. 258). In his book *Myths and*
294 *Legends of flowers, trees, fruits and plants*, Skinner (1913) illustrates the importance of
295 flowers in salads, compared to their function as ingredients in other types of dishes: "*The*
296 *violet, like the rose, has been used as a food, not merely to colour and garnish puddings,*
297 *broths, and other dishes, but as a salad, mixed with lettuce and onions*" (Skinner, 1913, p.
298 280). Meanwhile, writing more than two centuries earlier, John Evelyn (1699) suggests
299 incorporating nasturtium flowers, elder flowers, gilly-flowers, and bugloss flowers, as well as
300 cowslip flowers and collyflowers into salads. He also talks of candied and pickled flowers,
301 flowers used as colouring agent, and cowslips used to make wine.

302 Gillyflowers are also mentioned as an ingredient in recipes dating back as far as 1753 (see St.
303 Stephens, 1965; and see Davidson, 1999, p. 221, on the use of clove-gillyflowers). Rose
304 petals were widely used in Elizabethan and Stuart England, to make preserves, candies, and

305 medicinal cordials (Wilson, 1973). Edible flowers were especially popular during Queen
306 Victoria's reign (Stradley, n.d.). A menu from the 8th of March 1858 of the High Sheriff's
307 Dinner at the Royal Station Hotel in York, England, shows *Souffle a là fleur d'oranger* as
308 part of a Victorian dinner (National Railway Museum collection by
309 <https://intimesgoneby.wordpress.com/2018/03/08/on-this-day-a-victorian-dinner/>). Flowers
310 are also mentioned in Mrs. Beeton's (1836-1865) celebrated book of "Household
311 Management" (Beeton, 1861). They are normally mentioned as ingredients by this famous
312 writer of Victorian Britain, for sweets and desserts: For instance, *orange-flower water* as an
313 ingredient of "Maids of Honour", a dessert cake, savoy cake, lemon cake, German marzipan,
314 rout cakes (in French *petit fours*), macaroons, maraschino cream bon-bons, almond and
315 pistachio ice creams, grape water ice and almond ice for cakes/almond cake (where *rose*
316 *water* is also mentioned). *Elderflower water* was an ingredient in "grape sorbet" (Beeton,
317 1915). In the book's section on preserves: Crystallised flowers such as *violets*, *orange flower*,
318 *rose petals*, and *primroses* are mentioned. In the section concerning beverages: *clary*, *cowslip*
319 and *dandelion flowers* as ingredients added to make flavoured wines.

320 Interestingly, Mrs Beeton refers to the beauty of *clove flowers* in the section about spices:
321 "This very agreeable spice is the dried flower buds of the *Caryophyllus aromaticus*, a
322 handsome branching tree, a native of the Malacca Islands" (Beeton, 1915). The presence of
323 nasturtium (*Tropaeolum majus*) is celebrated in the salad section of this Victorian household
324 management book: "Its young leaves and flowers are of a slightly hot nature, and many
325 consider them a good adjunct to salads, to which they certainly add a pretty appearance....
326 which may be employed with great effect in garnishing dishes" (Beeton, 1915, p. 1174).
327 Almost 100 years later, in the mid-1950s, Elizabeth David (1955), a famous British Chef,
328 includes a recipe for a Lorraine salad with dandelion flowers in her popular cookbook.

329 In the cakes and breads section, there is mention of wedding or bride's cakes (decorated with
 330 natural flowers or the bride's bouquet of flower to make it somehow special). Interestingly,
 331 fruitcake has been traditionally the flavour of choice over the years for royal weddings and
 332 weddings in general. Nevertheless, Prince Harry and Meghan Markle for their wedding in
 333 2018 broke royal tradition by choosing a lemon and elderflower flavour, inspired by their
 334 spring wedding date ([https://www.brides.com/meghan-markle-prince-harry-wedding-cake-
 335 5184981](https://www.brides.com/meghan-markle-prince-harry-wedding-cake-5184981)). Kensington Palace tweeted the ingredients on the wedding's eve in case the public
 336 would like to reproduce it.¹¹

337 Flowers were photographed alongside with fruits by famous pioneer food photographer
 338 Roger Fenton, from mid-19th century (Victoria and Albert Museum) (**Figure 3**). In his still
 339 life photography,¹² flowers that have been historically used on food recipes, such as
 340 primroses, elderflowers, rose and lily. The Dutch Masters, celebrated by their still life
 341 paintings since the 17th century, normally reproduced cut flowers (the majority not edible).

342 PLEASE INSERT FIGURE 3 AROUND HERE

343

344 *3.2 The consumption of edible flowers in France*

345 In the 14th century, the King of France, Jean le Bon, bought more cinnamon flowers than
 346 cinnamon (which happened to be five times less expensive). Cinnamon flowers, actually the
 347 dried flower buds of the Indonesian cinnamon or cassia (*cinnamomum cassia*), were also used
 348 in medieval gastronomy, having a flavour that was, at least according to Laurioux

38 ¹¹ Historically, The Royals have influenced trends, fashion, and lifestyle in Britain (Okonkwo, 2016), thus, this
 39 flower flavoured Royal cake perhaps have an influence on considering the manufacturing of flower flavoured
 40 cakes instead of traditional fruity ones.

41 ¹² According to the Tate (<https://www.tate.org.uk/art/art-terms/s/still-life>), still life includes all kinds of man-
 42 made or natural objects, cut flowers, fruit, vegetables, fish, game, wine and so on. Still life can be a
 43 celebration of material pleasures such as food and wine, or often a warning of the ephemerality of these
 44 pleasures and of the brevity of human life.

349 (2021), choicer than that of cinnamon quills. According to Braudel (1973), writing about
350 France in the period 1400-1800, florate perfumes were preferred not merely to disguise
351 unpleasant bodily odour, but as an alimentary enhancer; extracts of amber, iris and rosewater,
352 orange petals, even flowers of nutmeg, were added to stews, pastries, and sauces. Edible
353 flowers are also to be found in a 17th century book *La Maison réglée* by *Nicolas Audiger*,
354 favourite confectioner of the extravagant court of Louis XIV, the Sun's King. Rosemary
355 flowers (*Salvia rosmarinus*) to make the "water of the Queen of Hungary". The author give
356 advice on how to boil the flowers with water to give "taste" to the liqueurs. In the recipe for
357 red ratafia, the use of flower as a colourant gives and its safe consumption aspect is
358 reinforced: "*We can also put poppy flowers, it's not bad and doesn't hurt*" (Audiger, 1692, p.
359 216). The author describes a recipe for making orange blossom water and cite that this same
360 recipe can be applied to make water from other scented flowers, such as violets, daffodils,
361 clove flowers, jasmine, musk roses, tuberose flowers (*Polianthes tuberosa*). Interestingly, he
362 pointed out in the end of the paragraph that "*and generally from all other scented flowers*"
363 (p. 213), affirming that this recipe can be reproduced using other aromatic flowers. He also
364 refers to how to glaze flowers in order to use them as adornments in dinners. Interestingly, in
365 his seminal book, a great number of flowers are mentioned as ingredients to flavour dishes
366 instead of only as a visually-appealing adornment. The use of flowers as an adornment for
367 instance, was more common later, as the example of the books from the 19th century suggests.

368 Edible flowers found an important place as refining adornments on dishes and are
369 immortalised in the books of great names of the French gastronomy, such as Marie-Antoine
370 Carême and Auguste Escoffier. Chef Marie-Antoine Carême, known as the foremost Chef
371 Pâtissier of his day (Head Chef of prominent gentlemen such as the Tzar Alexander I of
372 Russia and the Prince Regent of Britain (later King George IV) insisted on the use of finest
373 and most expensive ingredients, for his architectural pieces. One of his memorable, exquisites

374 and gracious cooking sculptures is cited in the article “*Carême or the last fires of the*
 375 *decorative kitchen*” by Bonnet (1977, p. 40): “*In the example of the “Sultane en surprise”,*
 376 *Carême works the sugar like a glass craftsman. He makes a globe of spun sugar and places*
 377 *inside “a beautiful bouquet of pretty spring flowers”*. The author affirms in the following
 378 paragraph that “*At Carême all the decor is eaten, and this produces surprising distortions*
 379 *and discrepancies between the visual and taste effects”*. This is perhaps one of the earliest
 380 observations of what later on would be known as a crossmodal effect, a subject *a la mode* in
 381 the realm of sensory sciences of the 21st century (Spence, 2017).

382 Violets¹³ gained special attention in the cookery book of Alexandre Dumas (the author of The
 383 Three Musketeers) “*Dictionary of cuisine*”, published posthumously in 1873 (Dumas, 2015).
 384 In the section describing violets, Dumas writes: “*Flower whose name awakens the most*
 385 *spring ideas. Who says violet, says shadow, says freshness, says modesty, says stream*
 386 *running through the grass. There is no poet, however erotic like Parny, however romantic*
 387 *like Hugo, who has not found the name violet at the end of their rhyme; it is a sweet and*
 388 *fragrant name. The cornflower, that charming wheat sapphire, comes only after the violet in*
 389 *the poetic series of field flowers. Alive, it is intended to adorn the bodices of young ladies;*
 390 *dead, it lends its aroma to sweets, liqueurs, sorbets, preserves, and other compositions of the*
 391 *pantry. The violet ice creams are one of the most esteemed catteries of the fond”*. Other
 392 recipes using violets are *marmalade aux violettes* and *sirop de violettes*. An interesting
 393 passage of the book refers to the aromatic properties of violets mixed with iris, and how this
 394 could, on first exposure, seems bizarre: “*You know all the salads, right? from escarole to*
 395 *romaine lettuce; only, in the rather extraordinary case where you would like this species of*
 396 *Eudine entitled Cap’chin’s beard, I would give you advice which will perhaps seem a little*

45 ¹³ Candied violet blossoms were known to be the favourite sweet of the legendary Empress of Austria and
 46 Hungary, Sisi. Nowadays, different confectionary houses in Vienna make use of Empress Sisi photography in
 47 their packaging, for violet blossoms candied according to the traditional original recipe. French houses such as
 48 *Ladurée* also produce these violet candies nowadays.

397 *strange to you at first, but whose excellence you will later recognise: is to mix in some violet*
 398 *flowers and to throw in two or three pinches of this iris of Florence which one puts in a*
 399 *sachet to perfume the linen*". Other flowers that are cited include jasmine (used only for
 400 sorbet manufacturing), and orange blossom water for a diverse range of recipes.

401 The book "*Le Grand Livre des Menus*" from Escoffier, Gilbert, and Fetu (1912) highlights a
 402 more versatile trend in terms of the use of edible flowers in the context of food (i.e., its
 403 flavours), in addition to the decorative one (i.e., made famous in France by Carême's
 404 creations since the end of the 18th century). Inspired by menus created for different contexts
 405 of eating, from seasonal everyday cooking to ball dinner menus in the late 19th and early 20th
 406 centuries, the authors contextualise the use of flowers (especially violets) in recipes for
 407 different eating occasions. For seasonal consumption: In March – *Omelette soufflé aux*
 408 *violettes* (as a 'between-dishes') and *Biscuit glacé aux violettes*, also present in three other
 409 menus: the menu "maigre"/Eng. "lean" menu (pp. 88-90), the Christmas and New Year menu
 410 – where it is paired with "fine Champagne 1830" – p. 111, and in the menu of the elegant
 411 Carlton Hotel – p. 101); July – Courgette flowers for soup. For Dinner Ball – *Petites laces*
 412 *fleuries; Glaces moulées, fleurs et fruits*. For wedding menus – *Bavarois aux violettes*. For
 413 *dinner enfantin* /Eng. Children's dinner – *Gelée aux violettes*. For *Bébé souper* /Eng. Baby
 414 supper – floral salad.

415 The celebrated French Chef Joël Robuchon¹⁴ was known for adding edible flowers in his
 416 dishes, turning simple or lavishes ingredients into something sumptuous, in his many
 417 *L'atelier de Joël Robuchon* restaurants around the world (i.e., Paris, Las Vegas, London,
 418 Macao, Tokyo, Hong Kong, amongst many others)
 419 (<https://www.tastewiththeeyes.com/category/flowers/>). In 2012, he was invited to challenge

49 ¹⁴ French Chef, and restaurateur, named by the guide Gault Millau in 1989 "Chef of the century", as well as
 50 *meilleur ouvrier de France* (Eng: France's best worker) in cuisine in 1976. In the year of his death in 2018, he
 51 was the most awarded Michelin-Star Chef in the world, with 31 stars.

420 the contestants of MasterChef France Saison 3. The challenge was to make a tomato salad. In
 421 the tomato salad he created, flowers were used as an adornment. Interestingly, the Season 3
 422 of MasterChef France in 2012¹⁵, saw a growing interest in introducing flowers into the
 423 challenges for contestants through the creations of many other French celebrated guest Chefs
 424 such as Jean Luc Rabannel, Alexandre Gauthier, and Anne Alassane. In the season's final
 425 episode, one of the young contestants, Pierre Lefebvre, raised one of the most important
 426 characteristics of flowers, its decorative aspect in foods, what perhaps happen in everyday
 427 amateur kitchens worldwide: when the use of flowers as a decorative purpose goes beyond its
 428 taste/aromatic sensory characteristics, perhaps due to its unpopularity in nowadays cuisine.
 429 He affirmed *flowers aren't my thing in the kitchen, I think it's useless, but hey, I'll put it to*
 430 *decorate what!* Chef Yves Camdeborde, a member of the program's jury, in his reply,
 431 touched an important, a desired sensory property to be found on many dishes: the capacity of
 432 flowers on disclosing on tasters the perception of freshness. He affirmed: *it's not just*
 433 *decoration, on the contrary, it can often bring real freshness to a dish.* This passage in the
 434 program shows how important these food cooking shows can be in terms of food education
 435 both to the contestants as well as to the many people watching at home. Nowadays, the
 436 former contestant, now Chef restaurateur Pierre Lefebvre, owner of the restaurant *L'accolade*
 437 at Caen in Normandy, makes use of different edible flowers in many of his creations.

438

439 3.3 On the popularity of edible flowers in Europe

52 ¹⁵ Despite the diversity of application of edible flowers in MasterChef's France kitchen, the Australian version
 53 of the program five years later, apparently, did not see edible flowers with the same enthusiasm. The
 54 MasterChef judges share with the media, the foods they've 'banned' for the 2018 season, and amongst them,
 55 edible flowers. Judge Matt Preston explains: *Edible flowers have become the micro herbs of five years ago.*
 56 *Garnish for garnish sake has always been on the out for us. If you can't eat it, what's it doing on the plate.*
 57 (<https://www.mamamia.com.au/masterchef-banned-foods/>).

440 Historical records shows that flowers were also very popular in other sovereign territories
 441 across Europe and their colonies. In Portugal, for example, a cookbook by His Majesty’s
 442 Chef, Domingos Rodrigues – “*A arte da cozinha*”¹⁶ (The art of the kitchen) (Rodrigues,
 443 1680) highlights the use of the nutmeg flower (both dried and fresh) – *Myristika fragans* – as
 444 an ingredient in “pudim à inglesa”. This flower originates from the small Banda Islands in the
 445 Moluccas, Indonesia, and was brought from there by Portuguese explorers. This fact shows
 446 how sophisticated and exotic the culinary habits of the Portuguese court from the 17th century
 447 actually were, richly embedded by ingredients from its colonies. Orange blossom is another
 448 of the ingredients mentioned in the book and is used in a variety of ways, e.g., in desserts,
 449 cakes, breads, sweet pies: naturally, toasted, preserved, as a flavoured water. There is even a
 450 recipe for a dessert called *Florada* – “flowering” for the literal translation. Interestingly, a
 451 new edition of this book was published in Rio de Janeiro, Brazil, in the times of the Brazilian
 452 Empire in the 19th century. In the new edition of 1838, orange blossom would appear to have
 453 been the rule, rather than the exception, in the diet of the Brazilian court (Rodrigues, 1838). It
 454 can be seen in a variety of recipes and not only for desserts and sweets but also as an
 455 ingredient – orange blossom water and natural – in soups and broths. Later, in Portugal, in the
 456 early 20th century, flowers as a food were much more diverse and were also incorporated into
 457 other categories of foods recipes such as soups, broths, biscuits, eggs and creams (orange
 458 blossom), appetizers (pomegranate flower, rose), condiments (acacia flower, angelica flower
 459 and nasturtium), preserves and salads (nasturtium), colouring of butter (marigold), ice cream
 460 (jasmine, violet, rose, *Iris florentina*, and orange blossom).

461 Wild flowers have been present in the diet in Scandinavia for centuries, and not only in the
 462 Greenlander Eskimo. According to Svanberg and Egißson (2012), flowers were extensively
 463 used in the Faroe Islands and Iceland since the first settlement of Norse people in the Viking

58 ¹⁶ *A arte da cozinha* by Domingos Rodrigues is known as the first culinary treatise in the Portuguese language
 59 published for the first time in 1680.

464 age (the 9th and 10th centuries). In the Faroes, people made tea from the flowers of *Thymus*
 465 *praecox* Opiz. In Iceland, there are many swathes of angelica and special angelica gardens
 466 were known to exist in the times gone by. Many toponyms still remind us of places for
 467 harvesting angelica. Grágás, the law book of the Icelandic Commonwealth (930–1262/1264),
 468 refers to penalties incurred for the theft of angelica, some as serious as being outlawed or
 469 fined heavily if the plant was stolen from someone else’s garden (Svanberg & Egišson,
 470 2012).

471 The “Classic Russian Cooking: A gift to young housewives” by Elena Molokhovets (1998),
 472 written in the times of Tsarist Russia of the 19th century, and continuously printed until the
 473 Communist Revolution in 1917, contemplates in the “Appendix A: Ingredients by category”,
 474 a section on “flowers, seeds, and nuts”. In this section flowers such as jasmine, mignonette
 475 flowers (*Reseda odorata*), nasturtiums, orange blossoms, poppy seeds, roses and sunflower
 476 seeds are cited. Ingredients to elaborate recipes like ice creams, wafers, liqueurs, jams,
 477 waters, syrups, preserves and specific creations like “The Tsar’s Pancake”. She also allude of
 478 the taste of roses and how to use them: *Roses vary in colour and aroma as well as taste, much*
 479 *like different varieties of apples. Darker petals often have a stronger flavour than light petals,*
 480 *but for best flavour all petals should be used as soon as possible after gathering and cleaning*
 481 (Molokhovets, 1998, p. 436). This is perhaps the first time flowers are categorised as
 482 ingredients in a cookbook.

483 At the border of Finland, in the Republic of Karelia (northwest Russia), edible flowers from
 484 the boreal forest have been used by its inhabitants as important source of nutrients, mainly
 485 consumed during the soviet era (Kolossova, Belichenko, Rodionova, Melnikov, & Šoukand,
 486 2020).¹⁷ This important ethnobotanical work brings to the surface, a huge variety of species

60 ¹⁷ According to these authors, the Republic of Karelia is characterized by limited agriculture due to its northern
 61 location and mostly forested landscape and thus a higher percentage of wild food (as products of fishing,
 62 hunting, and gathering) in the daily diet.

487 of edible wild flowers, used in Karelian kitchens: *Taraxacum officinale* (sucked nectar);
 488 *Trifolium hybridum* L (jam, recreational tea, snack, salad, sucked nectar, additive to flour);
 489 *Syringa vulgaris* L. (jam); *Oxalis acetosella* L. (snack), *Linaria vulgaris* Mill (snack); *R.*
 490 *rugosa* (jam); *Filipendula ulmaria* (recreational teas); *Matricaria chamomilla* L. (recreational
 491 teas); *Matricaria discoidea* DC (snack). In the USSR, during the Holiday of Spring and
 492 Labor (May 1st), flowers were an important asset. It is characteristic that even mimosa salad
 493 became an obligatory element of the holiday – the same yellow and fluffy thanks to the egg
 494 yolk crushed on top and butter shavings. The same symbol was imprinted on all Soviet
 495 postcards that were customary to send for the holiday
 496 ([https://www.mk.ru/social/2018/03/06/istoriya-cvetochnoy-mafii-v-rossii-i-sssr-my-](https://www.mk.ru/social/2018/03/06/istoriya-cvetochnoy-mafii-v-rossii-i-sssr-my-pokopalis-v-arkhivakh.html)
 497 [pokopalis-v-arkhivakh.html](https://www.mk.ru/social/2018/03/06/istoriya-cvetochnoy-mafii-v-rossii-i-sssr-my-pokopalis-v-arkhivakh.html)).

498

499 3.4 On the use of edible flowers in the Orient

500 There is also a long history of using flowers as a food ingredient and adjuvant¹⁸ in the Orient.
 501 Among the numerous species used in folk medicine, *Malva sylvestris* L. (Malvaceae) stands
 502 out due to its variety of uses, with its consumption reported to have originated in 3000 BCE
 503 (Gasparetto et al., 2011). Archaeological studies in the region of Syria have shown the
 504 existence of *M. sylvestris* seeds in dental calculus human fossils, leading to the conclusion
 505 that the consumption of this species is longstanding, due both to it being an edible plant and
 506 to its possible medicinal properties (Henry & Piperno, 2008). For instance, according to
 507 Mirrazavi (2015), rose water has been produced in Persia for more than 2,500 years.
 508 Traditionally, rose water is made from oil extracted from the damask rose, and is used in

63

64 ¹⁸ The word "adjuvant" comes from the Latin word *adiuvare*, meaning to help or aid. "An immunologic adjuvant
 65 is defined as any substance that acts to accelerate, prolong, or enhance antigen-specific immune responses when
 66 used in combination with specific vaccine antigens.

509 cooking in Iran and Arab countries, as well as Türkiye, Bulgaria, India, China and so forth. It
510 is most commonly used in pastries, chocolates, preserves, sweets, and drinks such as liqueurs
511 (Zamani-Farahani & Fox, 2018). Perhaps the most famous use of rose water is in the
512 manufacture of one of the oldest and most delicate types of candy, namely *Lokum*, otherwise
513 known as Turkish delight (Efe & Dawson, 2022). Although its origins remain a subject of
514 intense debate amongst food historians, the most widely accepted theory is that it dates back
515 to the Ottoman Empire (1300-1918) and, according to the Turkish folklore, *Lokum* was
516 created when a Sultan ordered a confectioner to create a unique sweet to appease his
517 concubines, blending a concoction of various syrup flavours (primarily rose and lemon), nuts
518 and dried fruits (Batu & Kirmaci, 2009; Kehl, 2007). In the nineteenth century, a British
519 traveller to Constantinople became so enamoured with the Turkish delicacy that he purchased
520 several cases of *Lokum* and shipped them back to Britain under the brand name Turkish
521 Delight, where it became especially popular at Christmas (see Tannahill, 1973). Dried
522 flowers are also consumed in Iran, through their addition to yoghurt in order to help treat
523 digestive problems (Nikbakht & Kafi, 2008; see also Dorozko, Kunkulberga, Sivicka, &
524 Kruma, 2019, on the use of dried flowers in the Baltic region).

525 A recent book – *Chrysanthemum* – by Twigs Way (2020), states that in Japan, even since the
526 first celebrated “Chrysanthemum Imperial Festival” in 910 AD, chrysanthemum teas and
527 wines are drunk, and chrysanthemum flowers are floated on the traditional Japanese drink’s
528 sake., Small chrysanthemums are sometimes also used as garnish on foods. According to the
529 same author, in China, many cities and regions organize chrysanthemum festivals, such as the
530 “Xiaolanzhen Chrysanthemum Festival”, celebrated for the first time in 1736, one of the most
531 important. In that festivals, chrysanthemum cakes, soups and drinks are consumed.

532

533 3.5 Contemporary uses of flowers in a culinary setting

534 The book *Cooking with flowers – Sweet and savoury recipes with rose petals, lilacs,*
535 *lavender, and other edible flowers* from Bachet and Sweets (2013), may be seen as a
536 ‘coronation’ on the use of current mentioned flowers in history, as these ones pointed out in
537 the book’s title. There has been a contemporary emergence of interest in edible wild flowers,
538 and interesting to note that the biological activities and chemical composition one get from
539 flowers depends on their stage in season (Ammar et al., 2012). With its thick vines and vivid
540 flowers, bougainvillea (*Bougainvillea spp.*) has earned a place as a crowning glory in many
541 gardens. The so-called “flowers” are actually bracts, which are modified, coloured leaves.
542 This is the edible part. Toss out the small, narrow flowers attached to the centre of each bract.
543 The bracts are best used fresh, though they can also be steeped in tea, but don’t leave them in
544 the hot water for more than five minutes or so. They lose their sweet flavour and begin to turn
545 extremely bitter. A homemade *agua fresca* [Eng. Fresh water] made with cold water, lime
546 juice, sugar, and bougainvillea bracts is particularly tasty, while, camellias (*Camellia spp.*)
547 are showy and sweet, which makes them ideal as a garnish for desserts or fruit salads ([https://](https://gardenerspath.com/plants/flowers/edible-flowers/)
548 gardenerspath.com/plants/flowers/edible-flowers/). Furthermore, according to Nicknezhad et
549 al. (2023), consumers around the world want more from their food, and the addition of edible
550 flowers provides a simple and healthy means of improving the appearance of certain dishes.
551 In Italy, the wild poppy (*Papaver rhoeas* L.) or corn poppy, its seeds are used to flavour
552 cakes, biscuits, and bread, while leaves, especially the younger basal rosettes, are widely
553 used, mostly cooked, in the traditional cuisine of many Italian regions (in Salento, South
554 Apulia, Italy, they are known by the term “paparina” (Montefusco et al., 2015). In France,
555 fresh edible flowers can be easily purchased in traditional French markets, such –as the
556 ~~example of the~~ *Marché d’Arles*, in southern France. This is demonstrated in one of the
557 episodes of a traditional podcast *On va déguster* [Eng. We will taste it] by François Régis

558 Gaudry from France Inter. Walking through the Arles market, the broadcaster and his guest
 559 describe some of the flowers available at the "herbs" stand: Among them, nasturtium and
 560 verbena. Later in the same episode ~~about~~ concerning the cuisine of Arles and La Camargue,
 561 the broadcaster visits "La Chassagnette" – a 1-Michelin Star Restaurant in Camargue. An
 562 abundant garden of edible flowers is described: *it will have both annual flowers, perennial*
 563 *flowers, a lot of soy, it will have blackcurrants... and then, well... basically a lot of flowers*
 564 ([https://www.radiofrance.fr/franceinter/podcasts/on-va-deguster/on-va-deguster-du-mercredi-](https://www.radiofrance.fr/franceinter/podcasts/on-va-deguster/on-va-deguster-du-mercredi-12-juillet-2023-1633398)
 565 [12-juillet-2023-1633398](https://www.radiofrance.fr/franceinter/podcasts/on-va-deguster/on-va-deguster-du-mercredi-12-juillet-2023-1633398)).

566 Retail seems to be taking the lead on the sales of edible flowers ~~in few countries~~ on a few
 567 countries. Marks and Spencer, a luxury traditional UK supermarket, included edible flowers
 568 amongst their retail products. “British edible viola flowers”: a delicate garnish with a subtle
 569 flavour – says in the packaging. In their words, *the new edible flowers are set to make*
 570 *'everything you create Insta-worthy* ([https://metro.co.uk/2021/05/09/ms-is-now-selling-](https://metro.co.uk/2021/05/09/ms-is-now-selling-edible-flowers-to-spruce-up-your-summer-cocktails-14546635/)
 571 [edible-flowers-to-spruce-up-your-summer-cocktails-14546635/](https://metro.co.uk/2021/05/09/ms-is-now-selling-edible-flowers-to-spruce-up-your-summer-cocktails-14546635/)). In online retail Amazon
 572 Italy, a colourful range of fresh edible flowers are available to consumers under the slogan
 573 “*belli da vedere, buoni da mangiare*” (Eng. beautiful to look at, good to eat), using the
 574 aesthetic appeal of flowers to engage consumers. In Canada, retail explores the aesthetic,
 575 sensorial and seasonal appeal of edible flowers – “flash and flavour for summer salads”
 576 (<https://www.earthboundfarm.com/blog/edible-flowers-flash-and-flavor-for-summer-salads/>).
 577 In Germany, blogs explores the potential of wild edible flowers - *Delicious on the forest path*,
 578 including species like dandelion (*Taraxacum officinale*), black elder (*Sambuca nigra*),
 579 amongst others ([https://en.garden-landscape.com/edible-plants-you-can-find-these-in-](https://en.garden-landscape.com/edible-plants-you-can-find-these-in-germany-in-forest-8657)
 580 [germany-in-forest-8657](https://en.garden-landscape.com/edible-plants-you-can-find-these-in-germany-in-forest-8657)). In Austria, the blog “Jewish Food of Vienna - Explore the Culinary
 581 Heritage of Jewish Vienna” by Nino Shaye Weiss, discloses mention a cheesecake decorated
 582 with edible flowers and its symbolism within Jewish culture: The single most appropriate use

583 for edible flowers is for the cheesecake on *Shavuot*, when Mount Sinai was blossoming in
 584 anticipation of the Giving of the Law (*Torah*) (<https://jewishviennesefood.com/blooming-jewish-cheesecake-with-tablets-of-the-law-crust-freud-moses-a-mel-brooks-joke-recipevideo-edibleflowers-shavuoth-topfentorte/>).

587 Two of the most successful examples are the beverage and the candy drop industries, in the
 588 British Isles, Asia and Switzerland, respectively. Gin made from botanicals with added
 589 flowers, such as roses, i.e., the gins from the Royal Kew Gardens, and soft drinks made from
 590 elderflower and roses with lemon - which can be found in every supermarket in the UK, or
 591 teas made from “English roses”, have become very popular in England in recent years
 592 (Chapman, 2008). Here, one might only consider the recent rise of rose and cucumber flavour
 593 combination in Hendricks gin (<https://theginisin.com/gin-reviews/hendricks/>). In Asia,
 594 jasmine, rose, lily, forget-me-not, carnation, magnolia, chrysanthemum, chamomile are all
 595 used for tea (Gao et al., 2009; Han et al., 2019; Hu et al., 2019), hibiscus in sweet drinks
 596 (Cid-Ortega & Guerrero-Beltrán, 2015). The famous Ricola drops, made from Swiss alpine
 597 herbs/flowers – mallow, yarrow, elder, marshmallow plant, amongst others, also provide
 598 great examples of the use of flowers in contemporary food industry ([https://www.ricola.com/](https://www.ricola.com/en-gb/experience/world-of-ricola/discover-our-world)
 599 [en-gb/experience/world-of-ricola/discover-our-world](https://www.ricola.com/en-gb/experience/world-of-ricola/discover-our-world)). Another successful case of using
 600 flowers today is the case of French macarons and their perfumes. The famous house
 601 "Ladurée" with its "Eugénie Floral assortment" [deliyselesers](https://www.laduree.fr/en/gift-box-of-12-eugenie-floral-assortment-.html) macarons perfumed with rose,
 602 violet, and orange blossom ([https://www.laduree.fr/en/gift-box-of-12-eugenie-floral-](https://www.laduree.fr/en/gift-box-of-12-eugenie-floral-assortment-.html)
 603 [assortment-.html](https://www.laduree.fr/en/gift-box-of-12-eugenie-floral-assortment-.html)). These same flowers, have also ~~been the inspirationed for~~ [flavouringed](#)
 604 drops in [the](#) French food industry and in confectionary (e.g., think only of Palma violets).
 605 Contemporary use of flowers includes its colouring use (e.g., to colour yoghurt) (Pires et al.,
 606 2018a).

607 According to Kelley, Behe, Biernbaum, and Poff (2001b), nearly half of both groups of North
 608 American consumers surveyed indicated that they had eaten edible flowers in the past three
 609 months including: dandelion (*Taraxacum officinale*), nasturtium, lavender (*Lavandula*
 610 *angustifolia*), chives (*Allium schoenoprasum*), violet, borage, mint (*Mentha* spp.), tulip
 611 (*Tulipa* sp.), calendula (*Calendula officinalis*), arugula (*Eruca vesicaria*), and signet marigold
 612 (*Tagetes tenuifolia*). Other flowers that have been used in a culinary context in various parts
 613 of the world include male zucchini flowers, also known as courgette and vegetable marrow
 614 (*Cucurbita pepo* L.; Cefola, Amodio, & Colelli, 2016); tropical pumpkin flowers (Toro-
 615 Vélez, Chávez-Jáuregui, Wessel-Beaver, & Brunner, 2022),¹⁹ and edible squash flowers
 616 (*Curcubita pepo*; Aquino-Bolaños, Urrutia-Hernández, López Del Castillo-Lozano, Chavéz-
 617 Servia, & Verdalet-Guzmán, 2013). Courgette flowers, *Primula veris*, the cowslip, common
 618 cowslip, or cowslip primrose (syn. *Primula officinalis* Hill; Gilmartin, 2015), an herbaceous
 619 perennial flowering plant of the primrose family *Primulaceae*, is also eaten.

620 In contemporary Finland, edible flowers are mentioned in cookbooks, generally as a
 621 decorative purpose for reindeer carpaccio (in raspberry vinaigrette) and raspberry meringue,
 622 but also as a “tasteful” one, as it can be seen in Saira and Kallio’s (2009, p. 18) cookbook:
 623 “*The Scandinavian nature is abundant of all kinds of edible plants. Many of them are used in*
 624 *a salad almost or nature. In spring the dandelion covers the roadsides and lawns. No wonder*
 625 *as it is considered a weed! But the dandelion makes a delicious, unique and beautiful spring*
 626 *salad”. In this extract, we can observe that in contemporary Scandinavia, there is an effort to*
 627 *take advantage of available natural resources, such as the flowers of weeds, as mentioned by*
 628 *the authors. In the Nordic countries, for instance, this initiative is very strong amongst high-*
 629 *end culinary events, such as the Oysters Festival in Denmark (see **Figure 4**) and several*

67 ¹⁹ These researchers note that the consumption of staminate (male) flowers of squash and pumpkin (*Cucurbita*
 68 sp.) has generally been limited to summer squash (*Cucurbita pepo*), a species of temperate regions or highland
 69 tropical environments. In the lowland tropics of the Caribbean Basin, tropical pumpkin (*Cucurbita moschata*) is
 70 better adapted and more widely grown.

630 Michelin starred restaurants, such as the *Alchemist* in Denmark (see **Figure 5**); the restaurant
 631 *Dill* in Iceland; *Operakällaren* in Sweden and *Schlägergården* in Norway. The orange
 632 blossom, often forgotten in current Brazilian cuisine, has been rescued and is a key ingredient
 633 in the famous dessert “from mud to chaos”, that was cauthoreated by Brazilian Michelin
 634 starred chef and Brazilian MasterChef judge, Helena Rizzo
 635 (<https://manimanioca.com.br/gastronomia/>).

636

637 PLEASE INSERT FIGURES 4 AND 5 AROUND HERE

638 In Asia, it would seem as though flowers are still consumed currently, as part of traditional
 639 cultural food habits. In China, for instance, during the “Double Ninth Festival”²⁰ people still
 640 celebrating this day, by climbing high and drinking chrysanthemum wine (Li, 2018). In
 641 Korea, this festival is known as “Jungyangjeol” (*in Korean: 중양절*), and Koreans would
 642 consume chrysanthemum leaves in pancakes (Ria, 2010). Indeed, chrysanthemum is a very
 643 popular edible flower nowadays: Originally made in Hong Kong, chrysanthemum tea drink is
 644 available in the UK supermarkets such as Sainsburys
 645 (<https://www.vitavitasoy.com/en/product/vct/vct>).

646 On a recent study on the place of edible flowers in traditional Mexican cuisine (Mulík et al.,
 647 2022), identified 372 recipes for dishes containing four species of Mexican edible flowers
 648 dishes (squash blossoms (*Cucurbita spp.*), yucca flowers (*Yucca spp.*), coral tree flowers
 649 (*Erythrina spp.*), agave flowers (*Agave spp.*). The authors point out that, unlike fresh flowers
 650 used in some international dishes for ornamental purposes, Mexican edible flowers are
 651 seldom consumed raw; on the contrary, it is quite common for these ingredients to undergo
 652 some kind of cooking before being consumed, to eliminate their toxicity (Mulík & Ozuna,

71 ²⁰ The day is traditionally celebrated by activities including hill-climbing, drinking chrysanthemum wine,
 72 hanging dogwood sprays, and other customs handed down from the Han dynasty story of Huan Ching and Fei
 73 Chang-fang, and were all originally practiced to avoid disaster and danger (Rose, 2005).

653 2020; Mulík et al., 2022). Another interesting result of this work was to highlight the
654 ingredients used along with edible flowers in Mexican cuisine, being onion, hot pepper,
655 garlic, tomato, egg, oil the most frequently used.

656 In South Africa, the blooms are part of contemporary South Africans' lifestyle. Even in
657 coffee and cacao, edible flowers can be consumed, as advised by the Lifestyle Home Garden
658 Centre: *The Nutmeg pelargonium, small, white flowers with a pleasant spicy flavour that will*
659 *warm the cockles of your heart if used in desserts, drinks (try it in coffee or cocoa) and cakes*
660 (<https://lifestyle.co.za/edible-flowers/>). In Kenya, fresh edible flowers are offered on a next
661 day delivery to customers' houses ([https://greenspoon.co.ke/product/mlango-farm-edible-](https://greenspoon.co.ke/product/mlango-farm-edible-flowers-order-by-9pm-next-day-delivery-punnet/)
662 [flowers-order-by-9pm-next-day-delivery-punnet/](https://greenspoon.co.ke/product/mlango-farm-edible-flowers-order-by-9pm-next-day-delivery-punnet/)).

663

664 **4. Analysis of the functional properties of edible flowers**

665 There is growing interest in edible flowers in many parts of the world (Motti, Paura,
666 Cozzolino, & Falco, 2022). It's important to stress here that only a subset of flowers are
667 edible. Indeed, a number of flower varieties are poisonous to humans (Nicolau & Gostin,
668 2016) or disclose allergies during their consumption (see Lucarini et al., 2020, for a complete
669 review of the allergens that are present in edible flowers). However, amongst the many edible
670 varieties, a wide variety of flowers have, in recent years been demonstrated to possess a range
671 a health and nutrition-related properties (Majumder, Mishra, & Vikrant, 2023; Mulík &
672 Ozuna, 2020; Pensamiento-Niño et al., 2023). See Kumari Ujala, and Bhargava (2021) and
673 also Voon, Bhat, & Rusul (2012) and Bortolini et al (2022) for more on the healthy
674 phytochemicals present in a number of edible flowers. Four different flower samples (*Dahlia*
675 *mignon*, *Rosa damascena* 'Alexandria' and *R. gallica* 'Francesca' draft in *R. canina*,
676 *Calendula officinalis* L., and *Centaurea cyanus* L.) have been shown to possess moderate

677 bioactive potential (anti-oxidant, anti-proliferative, and antibacterial capacity; Kritsiet al.,
678 2022; Pires et al., 2018b; see also Miguel et al., 2016). Rose petals gave the best antioxidant
679 and antibacterial results, while dahlia and rose were the best in terms of their anti-
680 proliferative properties. Chrysanthemum flowers have also been reported to have anti-oxidant
681 properties (Cao et al., 2020). Other researchers, meanwhile, have been studying the
682 physicochemical qualities, anti-oxidant capabilities and nutritional value of flowers of several
683 edible species of wild dahlia (Espejel et al., 2019). Other edible flowers whose health-related
684 qualities have been documented include monks cress (*Tropaeolum majus*), marigold (*Tagetes*
685 *erecta*), and paracress (*Spilanthes oleracea*; Basch, Bent, & Foppa, 2007; Navarro-González
686 et al., 2015).

687 There is growing evidence to suggest that edible flowers can be used as a source of phenolic
688 compounds with bioactive potential (e.g., acting as a powerful anti-oxidant; He et al., 2015;
689 Kaisoon et al., 2011; Koike et al., 2015; Li et al., 2009; Li et al., 2014; Lui et al., 2009;
690 Loizzo et al., 2016; Mak, Chuah, Ahmad, & Bhat, 2013; Nanda, 2019; Navarro-González et
691 al., 2015; Tai et al., 2011; Takahashi et al., 2020; Vukics, Kery, & Guttman, 2008; Xiong et
692 al., 2014). It has also been suggested that certain flowers may have anti-aging properties
693 (Chen et al., 2020).

694 Our understanding of the various nutritional and health-related benefits of edible flowers
695 continues to grow (Niizu & Rodríguez-Amaya, 2005; Rachkeeree et al., 2018). The chemical
696 composition of pansy (*Viola wittrockiana*) and snapdragon (*Antirrhinum majus*) have been
697 studied as a source of bioactive compounds (González-Barrio et al., 2018). Certain edible
698 flowers have been documented to include various minerals and potassium (e.g., Halder &
699 Khaled, 2022; Rop et al., 2012; Sotelo, López-García, & Basurto-Peña, 2007). Certain flower
700 petals can also be used for the extraction of carotenoids (Kamalambigeswari & Jeyanthi,

701 2016). Rop and colleagues (2012) reported that the highest levels of mineral elements were
702 observed in the flowers of species chrysanthemum, dianthus or viola. With potassium being
703 the most abundant element, with a content ranging from 1,843 to 3,965 mg/kg of fresh mass.

704 It should perhaps not come as any surprise given what we have seen so far that nowadays,
705 certain edible flowers are even being positioned as functional foods (Gostin & Waisundara,
706 2019), and/or nutraceuticals (e.g., Janarny, Gunathilake, & Ranaweera, 2021; Moliner et al.,
707 2023; see also Dujmović et al., 2022; and Pinakin et al., 2020, on edible tree flowers). Since
708 the 1980s, there has been a resurgence of interest in the use of edible flowers when
709 entertaining at home and on gastronomic settings (Kelley, 2002). Because of that,
710 information concerning optimal storage temperature and shelf life of edible flowers (Bame,
711 2004; see also Fernandes et al., 2019; Kou, Turner, & Luo, 2012, for a commercial
712 perspective might be easily found (see Fernandes et al., 2020).

713

714 **5. On the multisensory appeal of flowers**

715 Taken as a whole, edible flowers can potentially stimulate all of the consumer's senses. As
716 Lauderdale and Bradley (2014) put it, consumers should enjoy the flavour, colour, and
717 texture that flowers can bring to food. Dandelion flowers are reasonably commonly eaten
718 though they can taste bitter (Markham, 2022; O'Connell, 2009). The yellow flowers that
719 cover gorse bushes have a taste that is said to be reminiscent of pineapple while smelling of
720 coconut (Boulter, 2020). According to Diacanu (2021), the unravelling of flavours in
721 nasturtium flowers is quite unlike anything else in the garden: expect the taste of rocket, then
722 honey as you reach the nectar at the centre and, finally, a generous hit of pepper right at the
723 end. Other fragrant flowers that might be incorporated in cuisine include pineappleweed
724 (*Matricaria discoidea*), also known as wild chamomile, disc mayweed, and rayless mayweed.

725 The flowers have a chamomile/pineapple aroma when crushed. The chamomile flower smells
 726 like pineapple – with gentle notes of apple, and a honey-like sweetness. The white flowers of
 727 hedge garlic (Jack by the hedge) are in leafless clusters, each with four petals in the shape of
 728 the St George cross. The flowers look pretty in a salad (Bird, 2015).²¹

729 The incorporation of flowers in a food or drink context can potentially convey a number of
 730 benefits and have a number of uses. There has long been an interest in using flowers such as
 731 turnsole as a colouring agent (e.g., in the context of mediaeval banquets; see Woolgar, 2018).
 732 Nowadays, flowers are sometimes used to help colour yoghurts, with popular suggestions
 733 including nasturtiums (Diacono, 2021; see also Garzón et al., 2015). Saffron (*Crocus sativus*
 734 L.), consisting of the stamen of the crocus flower has, at certain points in history, been a most
 735 expensive spice (Bolandi & Ghoddusi, 2006; Crossley, 2014; O'Donnell, 2021). Saffron's
 736 taste and iodoform- or hay-like fragrance result from the chemicals picrocrocin and safranal
 737 found in the stamen. Picrocrocin is a monoterpene glycoside precursor of safranal.
 738 Picrocrocin has a bitter taste, and is the chemical most closely associated with the distinctive
 739 taste/flavour of saffron. However, saffron's primary appeal is undoubtedly as a natural food
 740 colouring (see also Shiau, Yu, Li, Huang, & Feng, 2023, for another recent example of
 741 flowers being used as a colouring agent). Tulip leaves are also edible, though once again
 742 while being visually attractive, they have no real taste/flavour taste.

743 One might also consider the electric daisy in terms of the unique sensory properties it can
 744 elicit: *Acmella oleracea* is a species of flowering herb in the family *Asteraceae*. Common
 745 names include toothache plant, Szechuan buttons, paracress, buzz
 746 buttons, tingflowers and electric daisy. Its native distribution is unclear, but it is thought
 747 likely to derive from a Brazilian *Acmella* species. The most important taste-active molecules

74 ²¹ In *The accomplisht cook or, The art & mystery of cookery*, May (1660) recommends adding 'candy flowers',
 75 such as violets, cowslips, clove-gilliflowers, roses, primroses, borragge, bugloss, to salads.

748 present are fatty acid amides such as spilanthol, which is responsible for the trigeminal and
749 saliva-inducing effects of the plant (Benwick, 2007).

750

751 **6. Encouraging consumers to consider flowers as edible**

752 While the evidence reviewed here (see **Figure 6**) has hopefully made clear how flowers
753 would once have been considered for their culinary potential, in the current era in the west
754 that is typically not how consumers currently tend to categorize them (Rodrigues et al.,
755 2017). As such, if we are to encourage consumers to think differently about flowers then
756 some work will be needed to change their semantic representations, which is likely
757 determined socio-culturally (e.g., Bäckström, Pirttilä-Backman, & Tuorila, 2003; Mazzuca &
758 Majid, 2023).

759

INSERT FIGURE 6 ABOUT HERE

760 Mellish, Gomez-Corona, Mariutti and Rodrigues (2023) recently published a paper in which
761 they assessed more than 250k mentions in social media platforms of flower descriptors used
762 to describe beer, wine, tea, and cocktails, covering 13 English-speaking countries during a 12
763 month period. Different results merged from the collected data, confirming for example, the
764 popularity of rose as a floral descriptor, being the most mentioned in all countries. Another
765 interesting result was related to the diversity of flowers used to describe beverages, much
766 more diversified, in fact, than the traditional aroma wheels normally used as support by
767 academicians and people from the industry for the descriptive profile of these beverages. The
768 results also show that flower descriptors were sometimes coupled with other descriptors such
769 as green, sweet, refreshing, bitter, mint, and a few fruits. Relevant here, Chen and Wei (2017)
770 studied the factors influencing consumers' attitudes towards the consumption of edible

771 flowers. Their research conducted with 357 consumers in Taiwan showed that being curious
772 and the aroma were the greatest influences on attitude towards the consumption of edible
773 flowers. At the same time, however, recent reports have noted the rise in popularity of edible
774 flowers in many countries (Nicknezhad et al., 2023; Pires et al., 2021). However, eating
775 flower should be done cautiously because they can be also dangerous if the person who is
776 using them, doesn't have sufficient knowledge about them (Matyjaszczyk & Śmiechowska,
777 2019). As always, one also needs to be careful about foraging for edible flowers, on where to
778 harvest them. Places to avoid harvesting them from are those places where people walk their
779 pets, and where pesticides/weed-killers may have been used; though see Kosztolnyik, 1996).
780 In the future, it may make sense to consider combining edible flowers with other plants from
781 the garden (Scariot et al., 2017).

782

783 **7. Perspectives for the use of edible flowers**

784 Given the ubiquity of flowers, there would thus seem to be a great opportunity to reconsider
785 their role within contemporary cuisine, and to move beyond simply viewing them as merely
786 decorative, and/or for their fragrancing potential. In this way, the inclusion of flowers in the
787 diet, could be rapidly advanced through mainstream media. Television cooking shows and
788 video on-demand could potentially have a decisive impact on the proliferation of the
789 information about the versatility of preparation, and the various sensory/health benefits
790 associated with the consumption of edible flowers. According to Matwick and Matwick
791 (2023), food on television is a mainstay, with programs devoted exclusively to food and
792 cooking shows, internationally, reaching many millions of viewers. Thus, educational
793 cooking and lifestyle shows, as well as cooking and flower competition shows such as
794 MasterChef and The Big Flower Fight from Netflix, respectively, could play an important

795 role in boosting the consumption of edible flowers. Another important possibility of
796 spreading the versatility of application of edible flowers in cuisine, is through food podcasts.
797 According to Chartable, in 2019 there were 4,879 food-themed podcasts in the Apple
798 Podcasts library (<https://bellocollective.com/power-to-the-foodcast-967f63d8ca18>).
799 Therefore, educational episodes dedicated to show the history of edible flowers would be a
800 perspective for enhancing the interest of considering flower as foods. In the long-term, a good
801 prospect for inclusion of edible flowers in peoples' diets, would be the inclusion of these
802 flowers, in educational programs, as when children are learning about the nutritional
803 importance of food at school, the types of food (e.g., fruits, vegetables, cereals). Adding the
804 "edible flowers" category, would undoubtedly constitute an important milestone in its
805 positioning for massive consumption, along with mainstream supermarkets and home
806 delivery.

807 The fact of looking at edible flowers as crops, could symbiotically benefit both the
808 agricultural and the food industry sectors. This would lead to the diversification of
809 agricultural production which is a desired asset for good environmental practices in many
810 rural areas (Hinrichs, 2003). Taking a wider perspective, this would also help to diversify the
811 options of "foods for the future", such as the constant food industry search for alternatives
812 proteins to fight future shortages. In this way, the demonstrated positive attitude of people
813 towards flowers (see Rodrigues et al., 2017 for a review) and their eye-appeal could be used
814 as an advantage by the industry, as compared to other unfamiliar/novel sources of proteins,
815 such as edible insects, which presents a higher level of rejection due to neophobia (Bisconsin-
816 Junior et al., 2020, Sogari et al., 2023). Indeed, flowers are also a good, though
817 underappreciated, source of plant protein (Jakubczyk et al., 2022). In this way, the use of
818 edible flowers' extrinsic visual cues assets (e.g., colour) and intrinsic cues (e.g., flavour –
819 Pliner, 2008) could also help increasing the appeal of leafy green mixed salads (Spence,

820 2020a). The colourful aspect of salads for instance, could help to enhance people's positive
821 emotions and interest (Chonpracha et al., 2020) and subsequently, intake. A group of interest
822 here would be children, via the use of both intrinsic and extrinsic cues of flowers to enhance
823 their interest and intake of salads, both ready-to-eat and in salad bars in schools (DeCosta,
824 Møller, Frøst, & Olsen, 2017). Edible flowers can be considered a novel or unfamiliar food
825 depending on the culture the person is inserted in (see Tuorila, Lathteenmaki, Pohjalainen, &
826 Lotti; 2001 for a concept review). In our historiography research, we observed a diversity of
827 species of flowers used as well as, their culinary preparations, all grounded in culture.
828 Therefore, these flowers, even if they are familiar to adults from a cultural group (i.e., if they
829 heard about it or have already tasted), perhaps to children they are subjectively novel. And an
830 important goal of child feeding practices is to familiarise children with foods common in their
831 culture (Tuorila & Hartmann, 2020).

832

833 **8. Conclusions**

834 As this narrative historical review has hopefully made clear, there are a number of reasons as
835 to why edible flowers should be reconsidered as offering a potential source of nutrition (e.g.,
836 Cunningham, 2015; Fernandes et al., 2020; Lara-Cortés et al., 2013), as well as benefit
837 precursor and eye-catching element in dishes (e.g., in salads).²² There is, in fact, a long
838 history of flowers' use (such as squash flowers in Italy) in cuisine (Paris & Janick, 2004; see
839 also Guiné et al., 2020). Edible flowers can also provide an effective means of enhancing the
840 eye-appeal of a dish (Little, 1980; Spence, 2020a), something that is especially important in
841 the era of Instagram (Spence et al., 2022). Sometimes edible flowers may impart a desirable
842 flavour and/or unusual mouth-tingling sensation, as in the case of electric daisies.

76 ²² Given their low weight, the appeal of flowers is likely to lie more in the sensory domain.

843 There are growing concerns amongst the general public about food shortages, and
 844 increasingly urgent questions about how we will find our food in the months and years ahead
 845 (e.g., Sillars; 2023). Indeed, there is a growing interest in gastroporn – and thus an associated
 846 interest in the question of how to optimize the eye-appeal of the foods we eat, or at least that
 847 people post on social media (e.g., Kelley et al., 2001a, b, c; Spence et al., 2022; Spence et al.,
 848 2016). The incorporation of edible flowers in leafy green salads is no exception in this regard
 849 (Spence, 2020a), given that consumers really do eat first with their eye (Little, 1980).
 850 Historically, there has long been interest in the decorative role of flowers both in setting the
 851 table²³ (Attar, 1991; Burbidge, 1875; Mlcek & Rop, 2011; Spry & Hume, 1950; Wilson,
 852 1991), as well as in scenting the space (cf. Classen et al., 1994).²⁴ For instance, the tendency
 853 of men to wear gardenias in their lapels when going to the theatre (see Sebag-Montefiore,
 854 2016) would presumably also have helped to make the olfactory atmosphere in the theatre a
 855 little more bearable. Foraging for edible flowers also fits with recent trends such as a return to
 856 seasonal food consumption, reducing food waste, reducing food miles, and searching for
 857 alternative food sources. Health and nutrition properties of edible flowers (Benvenuti &
 858 Mazzoncini, 2021; Fernandes et al., 2017; Lu, Li, & Yin, 2016; Pires, Dias, Barros, &
 859 Ferreira, 2017).

860 [Around the world, innovative chefs would seem to have an important role to play in](#)
 861 [promoting \(or should that be repopularizing\) the culinary use of edible flowers \(Łuczaj et al.,](#)
 862 [2012; Taylor et al., 2023\).](#) [The hope is that it may be possible to move their use beyond even](#)
 863 [merely just a decorative element at seasonal meals. In this regard, food industry stakeholders](#)

77 ²³ Interesting, despite the fact flower arrangements have been used in table settings since ancient times, their
 78 influence on people's appreciation of beverages such as wines, have only started to be explored recently. A
 79 study by Rodrigues, Richards, and Carvalho (2023) demonstrates that the simple presence of flower
 80 arrangements in front of wine tasters, as well as its colour palette, influences (biases) the way in which wine
 81 tasters describe and appreciate wines. For instance, the same red wine described as 'robust' when no flower
 82 arrangement was present, was perceived as 'delicate', being also described as 'floral', and having 'perfume'
 83 when tasted in front of a delicate flower arrangement.

84 ²⁴ Consider only how in Ancient Roman times, the scent of roses would sometimes be sprayed over diners at
 85 dinners (Bradley, 2015; Draycott, 2015).

864 should take attention to the different historical possibilities of use of edible flowers in food
865 development (i.e., broths, jams, soups, preserves, biscuits, dried, powder, teas, flavouring and
866 colouring agents, syrups and juices). Considering flowers as crops for food manufacturing
867 would have a great impact on the diversification of rural production areas, usually stuck to
868 monoculture.

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870 | We thank wine expert, Mrs. Anna Moukhina for the ~~Russian~~ translation of the Russian
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872

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895 *général. Avec la véritable méthode de faire toutes sortes d'essences, d'eaux & de liqueurs,*
896 *fortes & rafraîchissantes, à la mode d'Italie* [The regulated house, and the art of directing the
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Figure Captions

1520

1521 Figure 1. The popularity of the imitation of the shape of flowers using different food
1522 materials – aesthetic appeal or multisensory experience?

1523

1524 Figure 2. Black and white mural by David Gentleman at the Northern line platform at
1525 Charing Cross tube station in London, UK.

1526

1527 Figure 3. Monochrome photograph depicting a still life of fruit, vegetables, flowers, and a
1528 vase by Roger Fenton. Victoria and Albert Museum collection, London, UK.

1529

1530 Figure 4. Oysters with edible flowers. 2021 Danish Oyster Festival at the Island of Rømø,
1531 Denmark.

1532

1533 Figure 5. “The tongue kiss” – Alchemist restaurant collection. The dish is served on a
1534 silicone tongue, cast from a human tongue as a way to bring guests out of their comfort zone.
1535 The dish changes with the seasons and is right now a gazpacho made from tomatoes, rhubarb,
1536 and strawberries, topped with herbs, edible flowers, and pinecones.

1537

1538 Figure 6. The versatility of application and consumption of edible flowers and their health
1539 benefits.