



## Letter to the editor

**Comment on article “Are wild and cultivated flowers served in restaurants or sold by local producers in Denmark safe for the consumer?” Food and Chemical Toxicology 120 (2018) 129–142. Doi: 10.1016/j.fct.2018.07.007**



Dear Sir, Editor of Food and Chemical Toxicology,

Being impressed by the amount of review work the authors have done and the quality of papers published in the Journal, I would like to comment on the article entitled: “Are wild and cultivated flowers served in restaurants or sold by local producers in Denmark safe for the consumer?” by Mikael M. Egebjerg, Pelle T. Olesen, Folmer D. Eriksen, Gitte Ravn-Haren, Lea Bredsdorff and Kirsten Pilegaard from the National Food Institute, Technical University of Denmark, Kemitorvet, Lyngby, Denmark, which was published in Food and Chemical Toxicology 120 (2018) 129–142. Doi: 10.1016/j.fct.2018.07.007.

I have researched the topic of edible flowers for 10 years from biochemical, culinary and ethnobotanical points of view. The first issue that surprised me during the lecture on the article was the authors' statement that there is a lack of proof of eating many species of flowers that actually are commonly consumed in southern and eastern Europe. I'm aware that analysis of plants eaten in this region of Europe is hindered by the fact that most publications are written in national languages and published mainly in small journals and monographs, however here in Poland we are very privileged by the activity of prof. Łukasz Łuczaj, one of the most reputable ethnobotanists in Europe, and the availability of a great number of his publications in Polish. Moreover, eating flowers has a long tradition in the culinary culture of Asia and the Middle East, as well as in the customs of Native Americans. For culinary uses of wild plants their experience is very valuable, although information from other continents may cause some problems in European legislation, then EU considers food eaten in other continents for centuries as novel food.

There might be some controversy over what the authors meant by fireweed, which is first listed as *Epilobium angustifolium* L., *Chamaenerion angustifolium* (L.) Scop. and *Chamerion angustifolium*, but is later referred only to *Epilobium*. However, fireweed understood as *Chamaenerion* has been consumed in Europe as a brew of oxidized leaves, stems and flowers since the 17th century. This tea is known as Koporsky czai, Ivan tea or Russian tea, and it was commonly exported to western Europe in the 19th century. (Łuczaj Ł: Dzikie rośliny jadalne Polski. Przewodnik survivalowy. Krosno: Chemigrafia, 2004.) You also stated that *Galium verum* was not used recently to 1997, however it was used to color the Double Gloucester Cheese and there is a traditional aquavitae in Denmark spiced with galium as well as German “maibowle”.

However if you are looking for evidence that flowers were eaten in Europe before 1997, then you should research also culinary sources and cook books as the edible flowers were not in concern of researcher so far. In 1993 the first farm in Poland near Gdańsk city started to grow

edible flowers in response to demands of restaurants, when the topic of edible flowers was already popular in western Europe. If you state that flowers like *Anchusa*, *Tagetes* or *Chrysanthemum* where not eaten in Europe before 1997 you just are not correct because those species were already offered in restaurants. Then publications by Jenny Leggatt (1987), Cathy Wilkinson Barash (1995), Jekka Mcvicar (1997), Kathy Brown, Rosalind Creasy, Miriam Jacobs (1999) popularized cooking with flowers more widely in modern cuisine.

As the authors write, “A Danish cookbook recently suggested the use of flowers, leaves and immature seeds from garden nasturtium (*Tropaeolum majus*) in salads or as fillings in omelet (Noack, 2017).” Actually this is not a new culinary idea. Nasturtium flowers, leaves and seeds were eaten in both Americas and England definitely before 1997, while pickled immature seeds of nasturtium are very well known in Polish cuisine as “false capers” since the 19th century.

There is also a controversy in the paragraph describing pot-marigold. The authors report that “An aqueous extract of flowers and leaves of *C. officinalis* was genotoxic when tested in the Comet assay (Sabir et al., 2015)”; however, in that study Sabir et al. conclude that *Calendula* extract is not genotoxic!

Furthermore the authors make a statement about *Viola tricolor*: “BVL lists the plant as List B: ‘Substances that are only used in food and for which a dose restriction is required due to certain constituents’”; however, the flowers of *Viola tricolor* are present on the list of the Danish Veterinary and Food Administration (the native office of the authors) as a plant for private use that can be eaten safely, while the greens of *V. tricolor* are allowed only under additional restrictions.

Moreover the authors mention a case of hemolytic anemia in a 9-month-old infant suffering from a metabolic error, glucose-6-phosphate-dehydrogenase deficiency, which in fact favors the development of that disease. Then it mainly supports the idea that herbal extracts should not be administered to infants, especially ones with congenital defects but it poorly refers to consumption of cakes decorated with viola flowers. Herbal extracts usually contain highly concentrated active constituents, in this case salicylate extracted from the whole plant, while in fresh flowers the amount of salicylate is much lower. Therefore, the risk is very low, especially when they are used sparingly in salad or dessert decorations. Of course, it must be borne in mind that every person has different susceptibility and some people more sensitive to salicylate, just as some are more sensitive to onion. And any two plants never contain the same concentration of active constituents, therefore then we can only operate with approximations and ranges of acceptable intake. However, I suppose that the medicinal extracts from whole plant are not in scope of study on eating flowers.

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About chrysanthemum, the authors wrote: “The content of camphor in the flowers does not give rise to a health concern since an adult (70 kg) may eat more than 3 kg fresh flowers (based on 0.13% essential oil with 29% camphor) before the maximum limit for acute toxicity of camphor is exceeded. In conclusion, no safe amount of flowers from *C. coronarium* for human consumption could be established due to limited phytochemical data and insufficient toxicological data.” The taste of chrysanthemum is distinct and intense, therefore it is hard to believe than anyone would like to consume more than one serving of 100 g, 200 g and still there is no evidence of toxicity of chrysanthemum intake and any suspicions of any other dangerous compounds. Please remind that *Chrysanthemum coronarium* is traditional food in Asia. Just food with no evidence of toxicity.

To continue with nasturtium, the authors state that “Doses of benzyl isothiocyanate (12.5–50 mg/kg bw/day for 14 days) that induced low foetal and placental weights (Adebiyi et al., 2004)”; 12,5 g of fresh flower per 1 kg of body weight under the assumption that all glucotropaeolin is converted to benzyl isothiocyanate it is very, very many flowers to eat. Intake of more than 700 g of nasturtium flowers every day for two weeks with its pungent, spicy taste? While nasturtium blossom weigh little, then half of kilogram of fresh nasturtium flowers would take the volume of few liters. So then your fears about health people who eat a plate full of flowers are unfounded.

Also, 20–80 g of fresh yarrow flower/kg bw means an adult eating 1.4 kg–5.6 kg of *Achillea* – in ten years of my studies on edible flowers I have never met a person who could eat more than a pinch of yarrow flowers due to its bitter taste and the culinary practice of using this plant only as a seasoning. Moreover, even the further calculation on thujone intake that limits *Achillea* consumption to 18 g a day still exceeds the typical usage of these flowers as seasoning that is measured in pinches.

Of course, there is the important problem of lack of botanical knowledge among cooks and consumers and the need for education on which species cannot be eaten for sure. In the article I found some species that I wouldn't consider as edible according to my experience, such as *Echium vulgare* or *Cytisus scoparius*. Another issue is making

consumers aware that ornamental flowers grown with pesticides or fungicides do not fit for consumption.

I fully support the necessity of more research on edible flowers, their composition, active constituents, health benefits and possible adverse effects. Specially in cases of people with greater sensitivity either in interactions with some drugs. The authors state that chefs and writers of cookbooks should not only focus on taste, food texture and beauty but also pay more attention to whether these flowers are safe to eat. Of course, I fully agree, but on the other hand I believe that the researchers also need to know the culinary context of tested material. I assume that authors of the article know flowers only as research objects and have never tried them. In my opinion researchers should also gain culinary knowledge, above European Union legislation restrictions and consider the usage of flowers in dishes and in eg. the weight of petals otherwise information about toxicity but without a context of the flavor, usage, volume of dish and health benefits of these species may cause panic that these flowers are toxic when they are used in culinary amounts. It is worth remembering that basilicum, nigella, juniper, chili, garlic or mustard also contain toxic compounds but are applied as spices due to their intense aroma, and it's hard to imagine a person who would consume large amounts of these plants, even though the upper limits of their intake are not always well established. However the consumers and readers of the article may lack the imagination how much is 12,5 g of nasturtium for 1 kg bw and they may not know that the full bowl of nasturtium salad is still far below the intake limit.

In conclusion, researchers, cooks, professional chefs and consumers need more information and more research. It's very good that scientists finally are interested in the phytochemical and toxicological studies of edible flowers. The main reason for starting the studies in this field is that there is not much data about flowers.

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