

## FOOD CHEMISTRY

# The sweet smell of sweat and cabbage

“The single odorants identified rarely have the typical smell of the food”

Chocolate, wine and food lovers begin their exploration of flavour with their eyes, moving on to touch and texture, followed by the smell and finishing with taste. But smell is not always afforded the importance it deserves in our judgement of a flavour. Quantifying smell is a difficult challenge because it is about more than simply concentration. Writing in the *Journal of Agricultural and Food Chemistry*, Carolin Seyfried and Michael Granvogl describe how they investigated this problem using two different types of dark chocolate. They were able to identify the key aroma compounds in chocolate using a combination of analytical techniques and sensory analysis from an experienced panel, and were ultimately able to reconstitute the chocolate aroma.

Although many reports have focused on textural characteristics of chocolate, only a few have analysed the aroma profile, and, until the work of Seyfried and Granvogl, no one was focusing on quantifying the contribution of each identified chemical to the aroma profile. “There is a lot of interest in the potential health benefits of dark chocolate,

but no one has previously undertaken a systematic study of its aroma,” says Granvogl. Their work focused on four complimentary streams: identifying the odorants, quantifying them, determining the respective odour thresholds to calculate the so-called odour activity values to get knowledge about their contribution to the overall aroma and finally, recreating the aroma profile.

To identify the compounds involved in the chocolate aroma, Seyfried and Granvogl used a combination of gas chromatography (GC) and mass spectrometry (MS), along with olfactometry — a technique that employs a trained panel of humans as a detector. Olfactometry was first described in the 1960s and enabled correlation between the analytical-instrumental detection of volatiles and their aroma attributes. The quantitation was performed for the most important odorants based on the results of olfactometry by the use of comprehensive two-dimensional GC–time-of-flight MS and stable isotope dilution analysis. “We were able to use the aroma profiles to build up an aroma that our panel of experts recognized as that of real chocolate,” says Granvogl.

The measurements revealed 77 odour-active compounds. Interestingly, the highest odour activities belong to qualities that no one would assign to chocolate, such as “cooked meat-like”, “flowery” or “sweaty”. Two different samples of dark chocolate were studied, with different but distinguishable cocoa content. It was revealed that the compounds with the higher concentrations (acetic acid, vanillin

and 2-phenylethanol) were not the ones with the highest odour intensities. Instead, the qualities associated with the highest intensities are described as flowery, meaty or sweaty. “The single odorants identified rarely have the typical smell of the food but in the right combination we can recreate a specific food odour,” explains Granvogl. Hence, a correlation between what can be seen through analytical techniques and what can be smelled is very important in order to bridge the gap between them. This correlation was based on the measurement of odour thresholds, which enabled the calculation of odour activity values for each component of the chocolate aroma. These results turn the table, putting the “cabbage-like” aroma of dimethyl trisulfide at the top of the odour activity profile, with “vinegar-like” acetic acid being the second key odorant in both chocolate samples.

This work reveals the complexity of chocolate aroma, using a systematic approach to tie together the compounds present, their concentration and the proportion of the individual aromas in the final aromatic character. “Our results can be used as the basis for quality criteria of dark chocolate and also to explore how changes in recipe, processing and storage change the aroma of chocolate,” says Granvogl.

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**ORIGINAL ARTICLE** Seyfried, C. & Granvogl, M. Characterization of the key aroma compounds in two commercial dark chocolates with high cocoa contents by means of the sensomics approach. *J. Agric. Food Chem.* <https://doi.org/10.1021/acs.jafc.8b06183> (2019)



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