Modelling of yogurt flavor by linking metabolomics data to sensory attributes.

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1. Introduction

DSM Food Specialties develops and sells products (e.g. enzymes and starter cultures) that improve the flavor, texture, quality and nutritional value of foods and beverages. In fermented milk products such as yoghurt, flavor is an important feature to ensure a desirable product quality. Understanding flavor at molecular level and the impact on sensory perception, enables steering of the desired product properties. To this end, we need to understand which metabolites in yoghurt can predict specific sensory attributes. This presentation outlines the workflow we have developed to identify mutual relations between metabolites and sensory attributes. This workflow is also used to identify relations towards sensory properties such as acidity, mildness, creaminess.

2. Approach

Yoghurts were produced under controlled conditions with ten different cultures, three milk bases with different fat and protein levels and two smoothening conditions (i.e. high and low shear applied with a back-pressure valve) according to a design of experiment containing 12 blocks of 6 products, including replicates to estimate the between-experiment variation. These yoghurts were evaluated per block by a 11-14 member trained panel on 24 sensory aroma, flavor, and mouthfeel related attributes following the QDA method. In addition, extended untargeted metabolites profiling was performed using 4 analytical platforms. The analytical platforms chosen aimed to cover the whole spectrum on molecules in dairy products that might contribute to flavor perception. We use for volatile metabolites GC-SPME-FID/MS, and for non-volatiles metabolites GC-OS-MS and NMR. Finally, we applied LC-MS for the profiling of peptides.

3. Results

Yoghurt production under 5L pilot scale was successful. The use of different conditions resulted in yoghurts with different flavor profiles according to our panel evaluations (Fig. 1). Metabolite profiles of these yogurts show they are different and that some metabolites are responsible for the difference. Finally, multivariate modelling of metabolite data showed correlation between some sensorial attributes and metabolites.

Figure 1. PCA visualization of flavor attributes of one yoghurt with difference processing parameters.

4. Discussion

A holistic metabolic profiling was applied to develop model to describe yoghurt flavor. The relationships that these models describe provide opportunities to understand and steer flavor in dairy food products. These opportunities are being investigated at this moment.