Introduction
The perceived freshness of the sensory qualities of breads is one of the key
determinants of bread acceptance. Consumers have a definite appreciation of
what constitutes freshness, based upon their individual experiences involving
complicated physiological and psychological processes. This perception is not
easily described, particularly as it is likely to vary from one bread type to another.
By linking descriptive sensory analysis and a rapid sensitive instrumental
technique such as Proton Transfer Reaction Mass Spectroscopy (PTR-MS) with
consumer freshness judgments, an objective interpretation could be used to
explain the freshness perception perceived by consumers.

Objective
• To relate consumer freshness judgments of
different bread types to descriptive sensory
analysis and volatile composition so an
objective understanding of the freshness
perception can be determined.

Methods
• Bread samples were selected from local commercial bakeries (n=10) and
national supermarket breads (n=9).
• Regular bread consumers (n=115) balanced by age and gender rated locally
baked bread (n=10) freshness on a 150 mm labeled magnitude scale (LMS).
Breads were assessed by appearance, smell, taste, and were then consumed.
A context was read to evoke a more affective response.
• A trained sensory panel (n=10) carried out descriptive analysis on all breads
(n=19) using a defined vocabulary of 27 attributes. Attribute intensities were
rated on unstructured 100 mm line scales.
• Headspace volatile composition of all samples (n=19) was conducted by PTR-
MS. Data was collected over a mass range of m/z 20 to 180. Mass ion
intensities were measured in ppb.
• With data from the 10 breads assessed by consumers, Partial Least Squares
Regression (PLS1) was applied to create three different models relating
sensory attributes to consumer freshness [Model 1], volatile composition to
consumer freshness [Model 2] and simultaneously sensory attributes and
volatile composition to consumer freshness [Model 3].
• Attributes and mass ion variables that contributed little information were
removed from the models. Optimum models were selected based on root
mean square error of prediction (RMSEP), which showed average uncertainty
expected when predicting consumer freshness. These models were used to
predict freshness of the 9 additional supermarket breads.

Result & Discussion
• Consumers significantly (F=12.717, p<0.05) discriminated differences between
bread types (n=10) selected from local bakeries based on freshness.
• Plots of consumers by bread type showed that all consumers perceived
freshness similarly.
• Twelve sensory attributes [Model 1] and twenty mass compounds [Model 2]
were correlated with consumer freshness. Calibration, validation and RMSEP
for both sensory and volatile composition data indicated models all had good
predictive power (Figure 1).
• Fresh bread could be described as having a porous (aerated) appearance,
malty, buttery odour, moist, fat (oily) texture with a burnt (toasted) aftertaste,
whilst least fresh bread was depicted as having dusty, musty and grain odour
with an adhesive coarse texture (Figure 1a).
• PTR-MS analysis distinguished bread differences by their volatile composition
and enabled correlations of specific mass ions associated with bread
freshness. Fresh bread was associated with mass ions likely attributed to
acetic acid, 2-methyl propionic acid, acetoin, 2-furfural, 2-heptanone, ethyl
butyrate, methyl-2-methyl butyrate, furaneol, 3-octanone, 4-vinyl-guaiacol, 2,3-
diethyl-5-methylpyrazine and vanillin (Figure 1b).

Conclusion
Relating consumer freshness judgments to sensory descriptive
analysis and volatile composition enabled an objective understanding of
bread freshness. This approach clearly showed specific sensory
characteristics and volatile compounds that were associated with the
freshest breads, and by doing so enabled a new and powerful
interpretation of bread freshness perception.

Figure 1: PLS1 analysis, indicates positive and negative loadings between sensory attributes (a) and volatile
compounds (b) associated with consumer freshness rating. Calibration, validation coefficient and root mean
square error of prediction (RMSEP) are shown. Bread freshness results measured by consumer sensory
analysis and predicted using descriptive sensory analysis and volatile composition for additional breads are
illustrated.

Figure 2: PLS1 analysis showing a biplot of the correlations between sensory data, compound mass
concentration and consumer freshness for 10 breads. Shown are predicted versus measured freshness
using the PLS model with calibration, validation coefficients and RMSEP.

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