Science Talks 13 (2025) 100423

Contents lists available at ScienceDirect

Science Talks

journal homepage: www.elsevier.es/sctalk

Determining sensory drivers of complex metadescriptors through regression modelling

Emily Fisher [a,d,*], Charles Diako [b,d], Rebecca Shingleton [c], Sidsel Jensen [a], Joanne Hort [b,d,e]

[a] Product Experience Sciences, Fonterra Research and Development Centre, Palmerston North 4472, New Zealand
[b] School of Food Technology and Natural Sciences, Massey University, Palmerston North 4410, New Zealand
[c] Category Innovation – Dairy Foods and Food Service, Fonterra, Palmerston North 4472, New Zealand
[d] Food Experience and Sensory Testing (Feast) Lab, Massey University, Palmerston North 4410, New Zealand
[e] Riddet Institute, Massey University, 4410 Palmerston North, New Zealand

ARTICLE INFO

Keywords:
Regression modelling
Creaminess
Multimodality
Sensory
Consumer
Complex terms

ABSTRACT

In sensory science, terms such as creaminess often lack precise definitions due to their multi-modal nature. Least absolute shrinkage and selection operator (LASSO), a regression technique known for automatic predictor selection, and partial least squares regression, which handles multicollinearity, were compared for their ability to accurately identify the underlying sensory attributes driving creaminess perception.

Twenty-eight sensory attributes were selected after discussions with milk consumers. Thirty-two milk samples were chosen to represent these attributes, spanning a wide range of creaminess. Quantitative descriptive analysis, with trained panellists, and a consumer study (n = 117 New Zealand milk drinkers) assessed the sensory attributes and creaminess ratings, respectively. LASSO and PLSR were compared for their predictive ability and attributes retained using sensory attributes (trained panel) as predictors and creaminess ratings (consumers) as the response variable. LASSO identified four key sensory attributes with a good model fit (R^2 = 0.951), while PLSR suggested thirteen (R^2 = 0.933). LASSO is effective in uncovering pertinent attributes within a complex sensory experience enabling cost-effective research. PLSR offers a comprehensive model for extensive product development. This research provides an alternative approach for determining pertinent attributes in complex metadesciptors. Resulting models offer clearer targets for product development, thus increased commercial gains.

Video to this article can be found online at https://doi.org/10.1016/j.sctalk.2025.100423.

* Corresponding author at: Product Experience Sciences, Fonterra Research and Development Centre, Palmerston North 4472, New Zealand.
E-mail address: emily.fisher@fonterra.com (E. Fisher).

http://dx.doi.org/10.1016/j.sctalk.2025.100423
Received 11 December 2024; Accepted 19 January 2025
Available online xxxx

Figures and tables

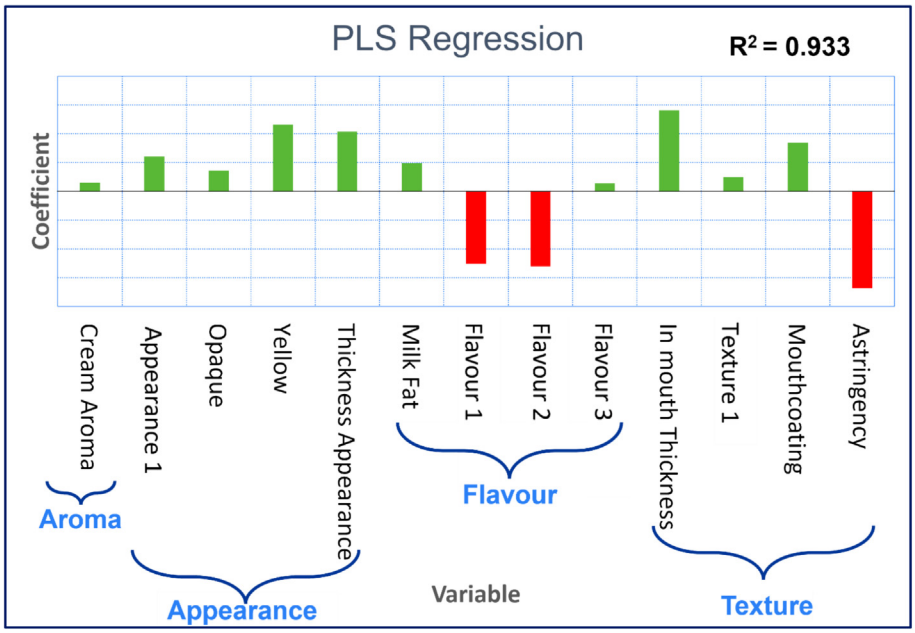

Fig. 1. Coefficient plot with sensory attributes retained for predicting New Zealand consumer creaminess perception with Partial Least Squares (PLS) regression analysis. The bar plot shows the thirteen of 28 sensory attributes retained within the model developed utilizing PLS regression and variable selection methods. Sensory attributes are distributed along the x-axis and the size of coefficients are represented on the y-axis. Each sensory attributes' contribution to the model, either positive or negative, is represented by the green or red coloring of the bar respectively. A number of sensory attributes eg 'Appearance 1' and values on y-axis have been blinded for confidentiality purposes. The modality of each attribute has been designated at the bottom of the plot and fit of model (R^2) at the top. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

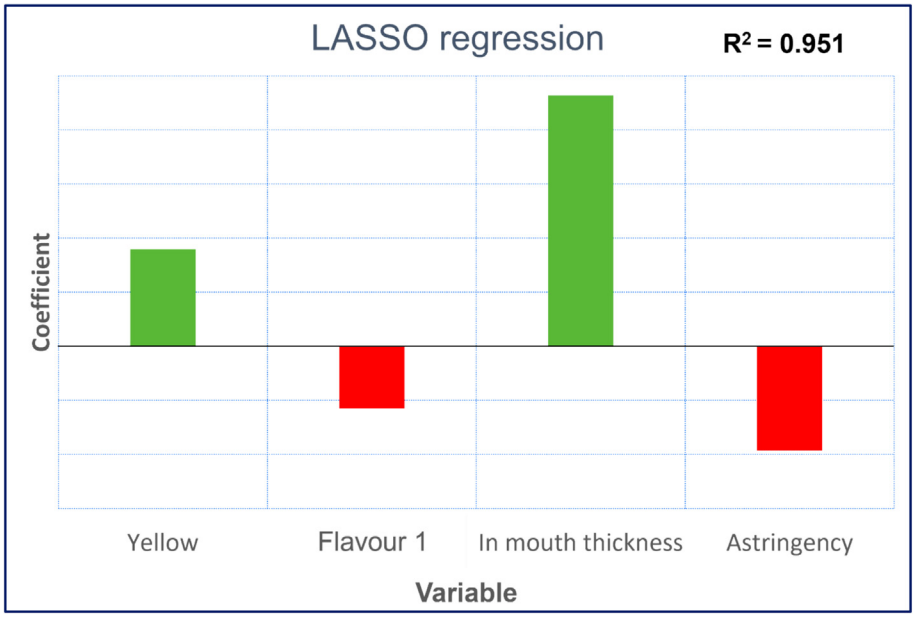

Fig. 2. Coefficient plot with sensory attributes retained for predicting New Zealand consumer creaminess perception with least absolute shrinkage and selection operator (LASSO) regression analysis. The bar plot shows the four of 28 sensory attributes retained within the model developed utilizing LASSO regression. Sensory attributes are distributed along the x-axis and the size of coefficients are represented on the y-axis. Each sensory attributes' contribution to the model, either positive or negative, is represented by the green or red coloring of the bar respectively. 'Flavour 1' and values on y-axis have been blinded for confidentiality purposes. The fit of model (R^2) is indicated at the top of the plot. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

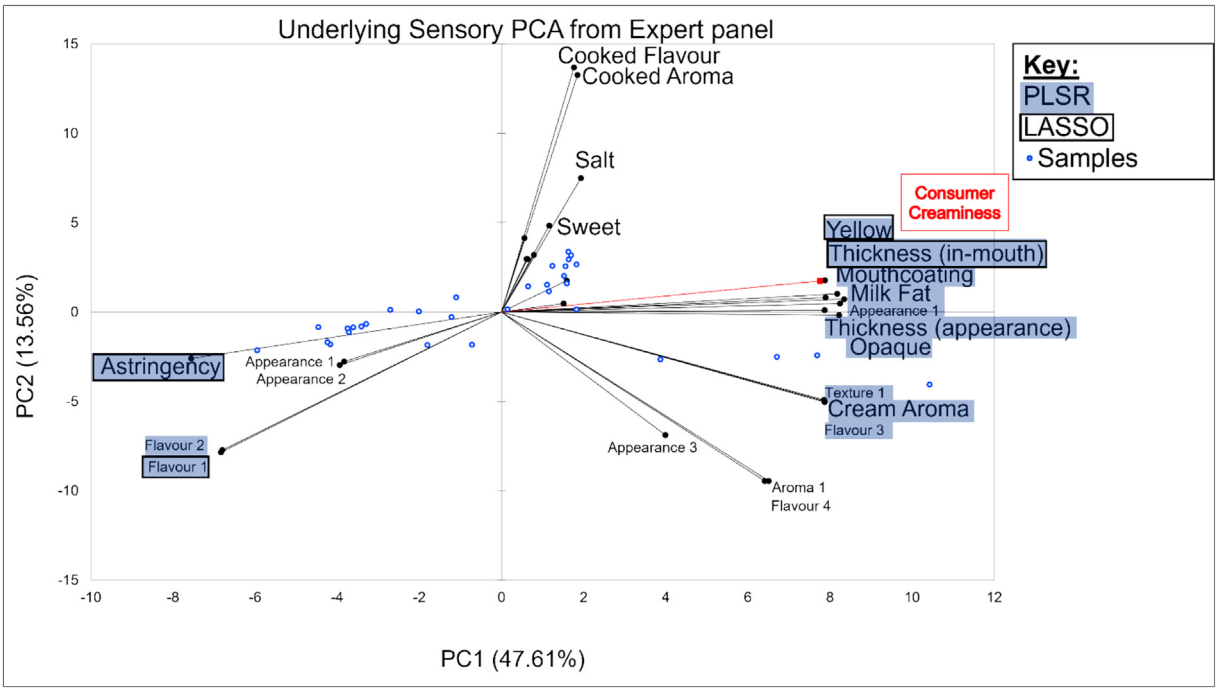

Fig. 3. Comparison of sensory attributes retained in each modelling methodology. The two modelling methods retained a different number of sensory attributes. The attributes retained are visually compared on the underlying sensory principal component analysis (PCA) plot from expert panellists. Attributes retained by partial least squares (PLS) regression are indicated by blue shading. The attributes retained by least absolute shrinkage and selection operator (LASSO) regression are represented by a rectangular black boarder. Each sample is shown by a blue circle. Mean intensity of creaminess from consumers is added as a supplementary variable and shown in red. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Funding

This work was supported by funding from Fonterra.

CRediT authorship contribution statement

Emily Fisher: Formal analysis, Investigation, Methodology, Software, Visualization, Writing – original draft. **Charles Diako:** Conceptualization, Methodology, Software, Supervision, Writing – review & editing. **Rebecca Shingleton:** Conceptualization, Funding acquisition, Methodology, Supervision, Writing – review & editing. **Sidsel Jensen:** Writing – review & editing. **Joanne Hort:** Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

Data availability

The data that has been used is confidential.

Further reading

[1] M. Kuhn, K. Johnson, Applied Predictive Modeling, vol. 26, Springer, 2013.

Emily Fisher is a Research Scientist in the Product Experience Science team at the Fonterra Research and Development Centre. Emily holds a PhD in Food Technology and has over 11 years of experience in the Dairy Industry.

Charles Diako is a Senior Lecturer in Food Technology at Massey University. Charles holds a PhD in Food Science with a statistics minor.

Rebecca Shingleton has over 20 years experience working in the Sensory and Consumer Science area, with the majority of her career in the Dairy industry. She is currently the Technical Engagement Manager for the Dairy Foods & Food Service Category Innovation team at Fonterra.

Sidsel Jensen serves as the Product Experience Sciences Manager at the Fonterra Research and Development Centre. Before her role at Fonterra, she worked for eight years at the Carlsberg Group. Earlier in her career she completed a postdoctoral fellowship at the University of Aarhus. Sidsel holds both a PhD in Food Science and an MSc in Food Science and Technology from the University of Copenhagen.

Joanne Hort is Fonterra Riddet Chair in Consumer and Sensory Science and is Director of the Food Experience and Sensory Testing (Feast) Lab at Massey University.