

### Sensory database Background information & context

Profiling the basic tastes and fat sensation using a trained sensory panel (SVT study)

Version 4

Agrotechnology & Food Sciences Group

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#### 1. Introduction

In the SVT (Smaak, Vet en Textuur) study we profiled the perceived intensities of the 5 basic tastes, i.e. sweet, salt, sour, bitter and umami, as well as fat sensation for 627 foods. Panellists were trained to evaluate the taste intensity and fat sensation using a modified Spectrum<sup>TM</sup> method (see appendix I-II). The solutions and foods have pre-defined anchors on a visual analogue scale. Using the Spectrum<sup>TM</sup> method, panellists have a similar frame of reference by which they evaluate foods (Meilgaard et al., 2007). To monitor the performance (discriminatory power, agreement and reproducibility) of the panellists, 8 control foods were profiled every 6 weeks. The paper describing the detailed data collection is: Teo et al., 2018. Below a summary of the data collection is given.

#### 2. Methods

#### 2.1 Subjects

Fifteen panellists were selected based on taste recognition, taste discrimination, mental concentration and sensory profiling abilities. The panel included 12 women and 3 men; aged between 20-50 years old, with a BMI between 19.1-27.6 kg/m² and no medication or health issues.

#### 2.2 Training and scale, reference foods

The training procedure has been described in more detail elsewhere (van Stokkom et al., 2016). Panellists received intensive training for a minimum of 63 hours in total, over a period of six months by means of reference solutions, modified products and several food products per basic taste. The reference solutions contained increasing concentrations of chemicals based on the basic tastes, i.e. sucrose for sweetness, sodium chloride for saltiness, citric acid for sourness, caffeine for bitterness and monosodium glutamate (MSG) for umami. For fat sensation only reference foods were selected, using a linear scale from 'not intense at all' to 'extremely intense'. The definition of fat sensation was obtained by consensus of the panellists. During the profiling phase of the study, 25 reference products were provided on request of the panellist (see Appendix II).

#### 2.3 Selection of foods for profiling

Foods (N=627) were selected based on food consumption data from the Dutch National Food Consumption Survey (DNFCS 2007-2010; van Rossum et al., 2011). The DNFCS provides information on dietary intake based on 24-hour recalls (in duplicate). Dietary intake of adults between 19-50 years old was used (N=1,402). The mean age of participants was 33±9 years old, with a BMI of 25±5 kg/m<sup>2</sup>, 704 were male and 698 were female. NEVO codes were selected based on consumption frequency, and contribution to the consumption of energy, macronutrients and sodium. In addition, NEVO codes were selected that explained most of the variation in energy intake of individuals. Expert knowledge from research dieticians was used for the selection of brands and standardization of preparation and serving methods. The twenty-three food groups were obtained from the Dutch Food Composition Database (RIVM, 2011). Products tested were given a unique food code, which was based as much as possible on the NEVO code. Exceptions were if multiple brands, flavours or preparation methods were tested for one NEVO code, foods were tested at both room and refrigerator temperature, when foods were tested as a reference or control food, or when foods were tested on request. Reference foods were profiled only on the dominant taste. The database file contains the exact type and brand which was profiled, including the method of preparation.

#### 2.4 Control foods

To monitor the performance (discriminatory power, agreement and reproducibility) of the panellists, 8 control foods were profiled every 6 weeks. These monitoring results described in Teo et al., 2018.

#### 2.5 Aggregated taste intensity values

Panellists profiled each of the foods in triplicate; these ratings were averaged to obtain mean taste intensity values for each panellist for each product. These values were again averaged, resulting in the mean taste and fat intensity values for each product. The data and a short description of the variables can be found in the file "20170202 Sensory database v004.csv". The file "20170202 Sensory database v004\_codebook.csv", contains the description variables in the dataset.

#### 2.6 Combining data with food consumption data

The database has been used as a basis for quantifying the exposure to basic tastes in several populations. The data has been merged for multiple purposes with 24h recall data and FFQ data of different populations. An overview can be found below.

#### **Used references**

Meilgaard, M.C., Civille, G.V. & Carr, B.T. (2007) Sensory Evaluation Techniques. (A. Arbor, 4<sup>th</sup> ed.) MI: CRC Press.

Rossum, C.T.M. van, Fransen, H.P., Verkaik-Kloosterman, J., Buurma-Rethans, E.J.M., Ocké, M.C. Diet of children and adults aged 7 to 69 years. *Dutch National Food Consumption Survey 2007-2010, RIVM-Rapport 350050006.* Bilthoven: RIVM 2011.

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Stokkom, V. I. van, Teo P.S., Mars, M., Graaf, C. de, Kooten, O. van, Stieger, M. (2016) Taste intensities of ten vegetables commonly consumed in the Netherlands, *Food Research International*. 87:34-41.

Teo, P. S., van Langeveld, A. W., Pol, K., Siebelink, E., de Graaf, C., Martin, C., ... & Mars, M. (2018). Training of a Dutch and Malaysian sensory panel to assess intensities of basic tastes and fat sensation of commonly consumed foods. Food Quality and Preference, 65, 49-59. 10.1016/j.foodqual.2017.11.011

#### Related publications

Lease, H., Hendrie, G.A., Poelman, A.A.M., Delahunty C. & Cox, D.N. (2016). A sensory-diet database: a tool to characterise the sensory qualities of diets. *Food Quality and Preference*, 49, 20-32.

Martin, C., Visalli, M., Lange, C., Schlich P. & Issanchou, S (2014). Creation of a food taste database using an in-home "taste" profile method. *Food Quality and Preference*, 36, 70-80.

Viskaal-van Dongen, M. V., van den Berg, M. C., Vink, N., Kok, F. J., & de Graaf, C. (2012). Taste–nutrient relationships in commonly consumed foods. *British Journal of Nutrition*, 108, 140–147.

#### **Publications based on the SVT database**

Van Stokkom, V. L., Teo, P. S., Mars, M., De Graaf, C., Van Kooten, O., & Stieger, M. (2016). Taste intensities of ten vegetables commonly consumed in the Netherlands. Food Research International, 87, 34-41. 10.1016/j.foodres.2016.06.016

Teo, P. S., van Langeveld, A. W., Pol, K., Siebelink, E., de Graaf, C., Martin, C., ... & Mars, M. (2018). Training of a Dutch and Malaysian sensory panel to assess intensities of basic tastes and fat sensation of commonly consumed foods. Food Quality and Preference, 65, 49-59. 10.1016/j.foodqual.2017.11.011

van Langeveld, A. W., Teo, P. S., Mars, M., Feskens, E. J., de Graaf, C., & de Vries, J. H. (2019). Evaluation of dietary taste patterns as assessed by FFQ against 24-h recalls and biomarkers of exposure. European journal of clinical nutrition, 73(1), 132-140. 10.1038/s41430-018-0300-1

van Langeveld, A. W., Teo, P. S., de Vries, J. H., Feskens, E. J., de Graaf, C., & Mars, M. (2018). Dietary taste patterns by sex and weight status in the Netherlands. British Journal of Nutrition, 119(10), 1195-1206. 10.1017/S0007114518000715

van Bussel, L. M., Kuijsten, A., Mars, M., Feskens, E. J. M., & van't Veer, P. (2019). Taste profiles of diets high and low in environmental sustainability and health. Food Quality and Preference, 78, 103730. 10.1016/j.foodqual.2019.103730

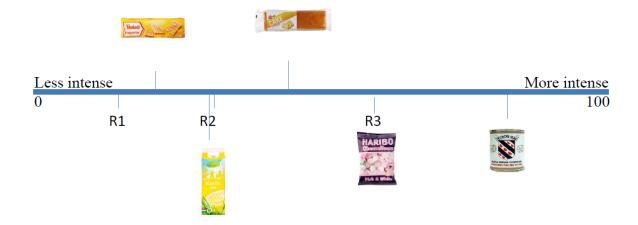
Nguyen, A. N., van Langeveld, A. W., de Vries, J. H., Ikram, M. A., de Graaf, C., Mars, M., & Voortman, T. (2020). Dietary taste patterns in early childhood: the Generation R Study. The American Journal of Clinical Nutrition.10.1093/ajcn/nqaa296

# Appendix I Nature and position of the reference solutions and products shown per taste and fat sensation

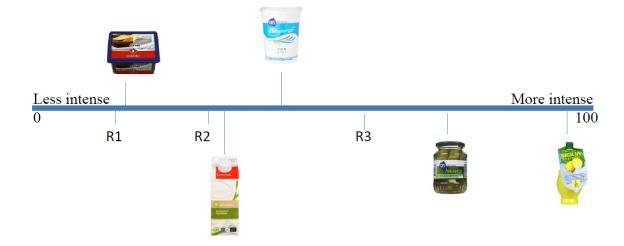
Food   %   Solution   %   Scale   Sc	Sensation	Food references	Solution references		
Sweet         Biscuits, Verkade Knappertjes         20.0         Sucrose 20 g/L (R1)         13.33°           Custard, Campina, vanilla         33.0         Sucrose 50 g/L (R2)         33.33°           Sponge cake, AH basic         50.0         Sucrose 100 g/L (R3)         66.67°           Marshmallows, Haribo Chamallows         67.0         88.0         88.0           Salt         Crackers, LU Cracotte         14.0         NaCl 2 g/L (R1)         16.67°           Potato crisps, Pringles Original         48.0         NaCl 3.5 g/L (R2)         33.33°           Cheese, Old Amsterdam, 48+         74.0         NaCl 5 g/L (R3)         56.67°           Sour         Rye bread, Bolletje, dark         38.0         Citric acid 0.5 g/L (R1)         13.33°           Butter milk, AH         38.0         Citric acid 0.8 g/L (R2)         33.33°           Youngle, AH Biogarde         50.0         Citric acid 0.8 g/L (R2)         33.33°           Bitter         Juice, AH, grapefruit         57.0         Caffeine 0.5 g/L (R1)         13.33°           Chocolate, Lindt, 85% cacao         Caffeine 0.8 g/L (R2)         33.33°           Umami         Seaweed, Saitaku Sushi Nori         48.0         MSG 1.2 g/L (R1)         13.33°           Crab sticks, Vici         Parmesan cheese, Zanetti G		Food	%	Solution	%
Custard, Campina, vanilla   33.0   Sucrose 50 g/L (R2)   33.33°     Sponge cake, AH basic   50.0   Sucrose 100 g/L (R3)   66.67°     Marshmallows, Haribo Chamallows   88.0   Sweetened condensed milk, Friesche Vlag   88.0     Salt   Crackers, LU Cracotte   14.0   NaCl 2 g/L (R1)   16.67°     Potato crisps, Pringles Original   48.0   NaCl 3.5 g/L (R2)   33.33°     Cheese, Old Amsterdam, 48+   74.0   NaCl 5 g/L (R3)   56.67°     Soy sauce, Kikkoman   94.0   Sight (R3)   56.67°     Sour   Rye bread, Bolletje, dark   38.0   Citric acid 0.5 g/L (R1)   13.33°     Butter milk, AH   70ghurt, AH Biogarde   78.0   Citric acid 1.5 g/L (R3)   66.67°     Sour pickles, AH   97.0   Caffeine 0.5 g/L (R1)   13.33°     Chocolate, Lindt, 85% cacao   70.0   Caffeine 0.5 g/L (R1)   13.33°     Caffeine 1.5 g/L (R3)   66.67°     Umami   Seaweed, Saitaku Sushi Nori   28.0   MSG 1.2 g/L (R1)   13.33°     Caffeine 1.5 g/L (R3)   66.67°     Crab sticks, Vici   43.0   MSG 3.0 g/L (R2)   33.33°     Caffeine 1.5 g/L (R3)   66.67°     Fat sensation   Crackers, Haust Snack cups   9.0     -     Crackers, Haust Snack cups   9.0   -   -       Crackers, Haust Snack cups   9.0   -     -       Crackers, Haust Snack cups   9.0   -     -       Crackers, Haust Snack cups   9.0   -     -       Crackers, Haust Snack cups   0.0   -             Crackers, Haust Snack cups   0.0   -			Scale		Scale
Sponge cake, AH basic   50.0   Sucrose 100 g/L (R3)   66.67a	Sweet	Biscuits, Verkade Knappertjes	20.0	Sucrose 20 g/L (R1)	13.33ª
Marshmallows, Haribo Chamallows   88.0   88.0   88.0		Custard, Campina, vanilla	33.0	Sucrose 50 g/L (R2)	33.33ª
Salt		Sponge cake, AH basic	50.0	Sucrose 100 g/L (R3)	66.67ª
Sweetened condensed milk, Friesche Vlag		Marshmallows, Haribo Chamallows	67.0		
Potato crisps, Pringles Original		,	88.0		
Potato crisps, Pringles Original		,			
Potato Crisps, Pringles Original   Cheese, Old Amsterdam, 48+   Soy sauce, Kikkoman   Sour   Rye bread, Bolletje, dark   Butter milk, AH   Yoghurt, AH Biogarde   Sour pickles, AH   Lemon juice, Sicilia, bottled   Sour pickles, Lindt, 85% cacao   Caffeine 0.5 g/L (R1)   13.33°   Caffeine 0.5 g/L (R3)   66.67°	Salt	Crackers, LU Cracotte	14.0	NaCl 2 g/L (R1)	16.67ª
Cheese, Old Amsterdam, 48+   74.0   NaCl 5 g/L (R3)   56.67a		Potato crisps, Pringles Original	48.0	NaCl 3.5 g/L (R2)	33.33ª
Sour   Rye bread, Bolletje, dark   15.0   Citric acid 0.5 g/L (R1)   13.33°   33.33°   Citric acid 0.8 g/L (R2)   33.33°   50.0   Citric acid 0.8 g/L (R2)   33.33°   66.67°			74.0	NaCl 5 g/L (R3)	56.67ª
Bitter Milk, AH Solienje, dark Yoghurt, AH Biogarde Sour pickles, AH Lemon juice, Sicilia, bottled P78.0 Caffeine 0.5 g/L (R1) 13.33a Caffeine 1.5 g/L (R3) 66.67a Caffeine 0.5 g/L (R1) 13.33a Caffeine 1.5 g/L (R3) 66.67a Caffeine 1.5 g/L (R3) 66.67		Soy sauce, Kikkoman	94.0		
Butter milk, AH   38.0   Citric acid 0.8 g/L (R2)   33.33a   50.0   Citric acid 0.8 g/L (R2)   33.33a   50.0   Citric acid 1.5 g/L (R3)   66.67a   50.0   Citric acid 1.5 g/L (R3)   66.67a	Sour	Due broad Pollotic dark	15.0	Citric acid 0.5 g/L (R1)	13.33ª
Yoghurt, AH Biogarde   50.0   Citric acid 1.5 g/L (R3)   66.67a			38.0	Citric acid 0.8 g/L (R2)	33.33ª
Sour pickles, AH   278.0   97.0			50.0	Citric acid 1.5 g/L (R3)	66.67ª
Lemon juice, Sicilia, bottled   97.0			78.0	- , ,	
Bitter   Juice, AH, grapefruit   57.0   Caffeine 0.5 g/L (R1)   13.33°   70.0   Caffeine 0.8 g/L (R2)   33.33°   Caffeine 1.5 g/L (R3)   66.67°		·	97.0		
Chocolate, Lindt, 85% cacao   To.0   Caffeine 0.8 g/L (R2)   33.33a   Caffeine 1.5 g/L (R3)   66.67a		Lemon Juice, Sicilia, bottled			
Umami       Seaweed, Saitaku Sushi Nori       28.0       MSG 1.2 g/L (R1)       13.33b         Crab sticks, Vici       43.0       MSG 3.0 g/L (R2)       33.33b         Parmesan cheese, Zanetti Grana Padano       69.0       MSG 7.0 g/L (R3)       66.67b         Soy sauce, Kikkoman       86.0       -       -         Fat sensation       Crackers, Haust Snack cups       9.0       -       -         Custard, Campina, whipped cream       55.0       -       -         Cream cheese, Philadelphia Original       72.0       -       -         Chocolate, Verkade, white       73.0       97.0       -       -	Bitter	Juice AH granefruit	57.0	Caffeine 0.5 g/L (R1)	13.33ª
Umami  Seaweed, Saitaku Sushi Nori Crab sticks, Vici Parmesan cheese, Zanetti Grana Padano Soy sauce, Kikkoman  Crackers, Haust Snack cups Custard, Campina, whipped cream Cream cheese, Philadelphia Original Chocolate, Verkade, white Unsalted butter, Boer en Land Friesland  Zas.0  MSG 1.2 g/L (R1)  MSG 3.0 g/L (R2)  33.33b  66.67b  69.0  MSG 7.0 g/L (R3)  66.67b  69.0  Associated Padano 69.0  MSG 7.0 g/L (R3)  66.67b  67.0  67.0  67.0  68.0  69.0			70.0	Caffeine 0.8 g/L (R2)	33.33ª
Crab sticks, Vici Parmesan cheese, Zanetti Grana Padano Soy sauce, Kikkoman  Crackers, Haust Snack cups Custard, Campina, whipped cream Cream cheese, Philadelphia Original Chocolate, Verkade, white Unsalted butter, Boer en Land Friesland  A3.0 MSG 3.0 g/L (R2)  MSG 7.0 g/L (R3)  66.67b  69.0 MSG 7.0 g/L (R3)  66.67b  67.0 -  72.0  73.0  97.0		5.1000 tato, 2.11at, 00% 5asas		Caffeine 1.5 g/L (R3)	66.67ª
Crab sticks, Vici Parmesan cheese, Zanetti Grana Padano Soy sauce, Kikkoman  Crackers, Haust Snack cups Custard, Campina, whipped cream Cream cheese, Philadelphia Original Chocolate, Verkade, white Unsalted butter, Boer en Land Friesland  A3.0 MSG 3.0 g/L (R2)  MSG 7.0 g/L (R3)  66.67b  69.0 MSG 7.0 g/L (R3)  66.67b  67.0 -  72.0  73.0  97.0	Umami	0 1071 0 171	28.0	MSG 1.2 g/L (R1)	13.33 <sup>b</sup>
Parmesan cheese, Zanetti Grana Padano Soy sauce, Kikkoman  Crackers, Haust Snack cups Custard, Campina, whipped cream Cream cheese, Philadelphia Original Chocolate, Verkade, white Unsalted butter, Boer en Land Friesland  69.0 MSG 7.0 g/L (R3) 66.67b  69.0 MSG 7.0 g/L (R3) 66.67b  7.0 The stress of the second		•		- , ,	
Fat sensation  Crackers, Haust Snack cups Custard, Campina, whipped cream Cream cheese, Philadelphia Original Chocolate, Verkade, white Unsalted butter, Boer en Land Friesland  86.0				- , ,	
Fat sensation  Crackers, Haust Snack cups  Custard, Campina, whipped cream  Cream cheese, Philadelphia Original  Chocolate, Verkade, white  Unsalted butter, Boer en Land Friesland  9.0				-	-
Crackers, Haust Shack cups  Custard, Campina, whipped cream  Cream cheese, Philadelphia Original  Chocolate, Verkade, white  Unsalted butter, Boer en Land Friesland  55.0 - 72.0  73.0  97.0		Soy sauce, Kikkoman			
Custard, Campina, whipped cream  Cream cheese, Philadelphia Original  Chocolate, Verkade, white  Unsalted butter, Boer en Land Friesland  55.0 - 72.0  73.0  97.0	Fat sensation	Crackers Haust Snack cups	9.0	-	-
Cream cheese, Philadelphia Original  Chocolate, Verkade, white  Unsalted butter, Boer en Land Friesland  72.0  73.0  97.0		•	55.0	-	-
Chocolate, Verkade, white  Unsalted butter, Boer en Land Friesland  73.0  97.0			72.0		
Unsalted butter, Boer en Land Friesland 97.0			73.0		
			97.0		
Campina		Campina			

### Appendix II Illustrations of fixed scales with reference foods and solutions

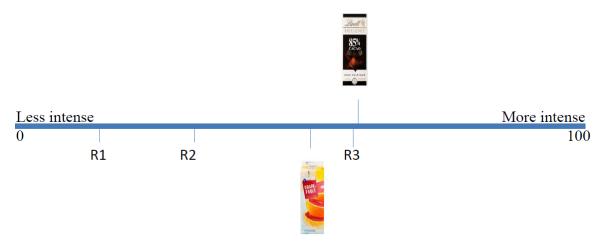
### Fixed scale (Sweet)



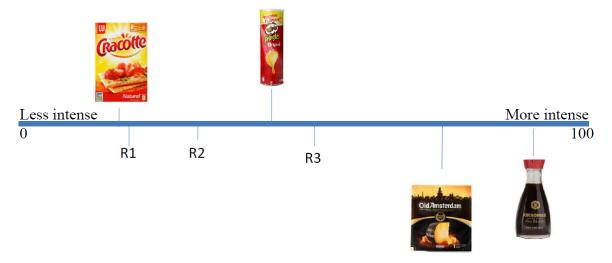
### Fixed scale (Sour)



## Fixed scale (Bitter)



# Fixed scale (Salt)



## Fixed scale (Umami)



### Fixed scale (Fat)

