

# Workshop sugar reduction: a science-based approach

Wageningen Food & Biobased Research  
19-08-2024



# Sugar reduction workshop

Part of 'Kennis-op-Maat' project quicker replacement of sugar in bakery products

*Knowledge transfer from WFBR to SME businesses towards*

- Achieving more optimal quality of sugar reduced bakery products in an effective way

# Sugar reduction approach

- Wageningen Food & Biobased Research developed a unique product specific sugar reduction approach based on the fundamental properties of sugar<sup>1,2</sup>
- Optimal mixtures of sugar replacers that take over the functionality of sugars in the recipe are calculated with the 'Sugar reduction tool'
- This approach allows:
  - 1-100% sugar replacement
  - Choice of sugar replacers
  - Remaining of texture and structure

Thanks to digital tool based on the principles of physics

**WUR sugar reduction strategy is quick and successful**

Sugar replacement in food products is challenging due to the different functions of sugar. Wageningen University & Research has developed a physics-based "sugar reduction strategy" and an associated digital tool to produce low-sugar recipes in an effective way.

# Sugar: a multi-functional ingredient

- More than sweetness
  - Structure
  - Texture
  - Mouthfeel
  - Colour
  - Flavour
  - Shelf-life



# Why choose for this science-based approach?

- Sugars are complex multifunctional ingredients that can exert different functionalities in different products → in every product a unique interaction with other ingredients
- To optimally replace sugars, their effects on the other ingredients in the recipe need to be replaced by the sugar replacers

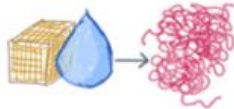
→ Water binding effect



→ competes with biopolymers for water during mixing

$$X_{eff}$$

→ Softening effect



→ works together with water to soften biopolymers

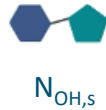
$$\Phi_{w, eff}$$

# Sugars functional effects captured in the 'Sugar reduction tool'

- Water binding ( $X_{eff}$ ) and softening ( $\Phi_{w, eff}$ ) behaviour of sugar and sugar replacers is

described by:

Effective hydrogen bonding



$M_w$  & Shape

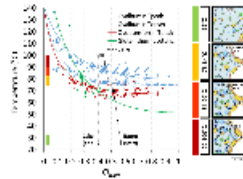


Molecular structure

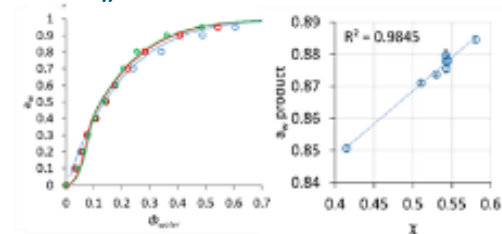


- Based on these ingredient properties, mixtures of sugar replacers are generated that exert the same effect as sugar on:

Viscosity, Gelatinization, Denaturation →  
Texture, Structure & Mouthfeel



$A_w$  → humectancy & shelf-life



# Digital 'Sugar reduction tool'

- Generates sugar reduced recipes (1-100%) with same texture and structure as original recipe
- Enables a quick and efficient development process
- Can involve Nutri-Score driven reformulation by selecting specific sugar replacers (e.g., fibres)
- Ensures process settings and other ingredients in the recipe are unchanged

Multi-criteria decision support

Ingredient	Amount (%)	Nutrient	Amount
White flour	24.4	Fibre (g)	0.488
Butter (Unsalted)	24.4	Sodium (g)	0.718
Emulsifier B746	1.22	Saturated Fat (g)	13.7
Sucrose	24.4	Total Carbohydrate (g)	42.2
Cake Flour (Flemings)	24.4	Fat (g)	22.4
Sodium Bicarbonate	0.195	Sugar (g)	24.8
Sodium Pyrophosphate SAPP 28	0.293	Protein (g)	5.69
Sodium chloride	0.683	Energy (kcal)	395

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# Applicability of WFBR sugar reduction research

- The sugar reduction principles apply to:

- Cookies
- Wafers
- Cakes
- Muffins
- Desserts



- Contact us to check if the principles apply to your product



# Understand the role of sucrose in cake

- This publicly available scientific article shows the effect of sugar during the processing steps involved in cake production

CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION  
2021, VOL. 61, NO. 16, 2756–2772  
<https://doi.org/10.1080/10408398.2020.1786003>



REVIEW

OPEN ACCESS Check for updates

## Understanding functionality of sucrose in cake for reformulation purposes

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<sup>a</sup>Wageningen-Food & Biobased Research, Wageningen University & Research, Wageningen, Netherlands

[Full article: Understanding functionality of sucrose in cake for reformulation purposes \(tandfonline.com\)](https://www.tandfonline.com)



# Typical project approach

- Informal meeting to introduce and discuss possibilities of cooperation
- When a project is opened, a typical project involves:
  - Meeting 1: discuss product(s) and reformulation goals, desired sugar replacers, requirements and benchmark recipes (NDA possible)
  - Evaluation of recipes: WFBR will evaluate recipes and decide if new ingredients need to be added to the tool database. If so, WFBR will request these specific ingredients' specifications by email
  - Updating database/running the tool: enter new ingredients, benchmark recipe and generate sugar replacer mixtures. WFBR will select sugar replacer mixtures, that based on the underlying principles of product interactions, matches best with the original recipe
  - Meeting 2: discuss proposed reformulated recipes: findings will be discussed in a meeting and shared in a pdf file
  - Product test: partner will test the proposed recipes and evaluate results
  - Meeting 3: evaluation meeting to discuss results of trials and evaluation. Next steps for optimization can be discussed (further optimization not included within the project boundaries)

# Contact information

For more information or signing up for the project contact either:

- ❑ Joost Blankestijn: [joost.blankestijn@wur.nl](mailto:joost.blankestijn@wur.nl)
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[Weblink: Reduce the sugar content of your products with the help of Wageningen experts - WUR](#)

[Verbeter de consumentenacceptatie van voedingsproducten met minder suiker - WUR](#)

[Digitale suikerreductie tool voor herformulering bakkerijproducten - WUR](#)

*Looking to reduce the sugar content in your products?*

Contact Joost Blankestijn for an informal discussion about the possibilities

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