Supplementary Material

Sugar guidelines should be evidence-based and contain simple and easily actionable messages

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**Online Supplemental Table 1** Examples of quantitative added/free sugars intake guidelines around the world

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| --- | --- |
| **Organization/Country** | **Guidelines** |
| *WHO* [1] | Reduction of free sugar intake to < 10% (strong recommendation) or 5% (conditional recommendation) of daily energy |
| *USDA* [2] | Limiting added sugar intake to < 10% of daily energy |
| *SACN* [3] | Limiting free sugar intake to < 5% of daily energy |
| *AHA* [4] | Limiting added sugar intake to ≤ 6% of daily energy |
| *CFSA* [5] | Added sugar intake at ≤ 50 g per day, preferably ≤ 25 g |
| *Ministry of Health of Brazil* [6] | Limiting added sugar intake to < 10% of daily energy |

AHA, American Heart Association; CFSA, China National Centre for Food Safety Risk Assessment; SACN, Scientific Advisory Committee on Nutrition; USDA, U.S. Department of Agriculture; WHO, World Health Organization

**Online Supplemental Table 2** – Examples of sugar reduction targets around the world

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| **Country** | **Targets** |
| *\*U.S.* [7] | 10% (2023) and 20% (2026) reduction from baseline sales-weighted mean sugar density (grams of sugar per 100 g of food) for sugar-containing solid foods; 10% (2023) and 40% (2026) reduction for sugary drinks from baseline sales-weighted mean sugar density (grams of sugar per 100 mL of beverages) |
| *The European Union and the U.K.* [8] | 10% reduction in calories from added sugars in soft drinks from 2019 to 2025 |
| *Australia* [9] | Muesli and snack bars: maximum 25 g/100 g and at least a 15% reduction for products containing > 28.5 g sugar/100 g by June 2025  Non-alcoholic beverages: maximum 5 g/100 mL by June 2025 |
| *New Zealand* [10] | Savoury snacks: maximum 25 g/100 g or 15% reduction for products with total sugar content significantly > 25 g/100 g (2019-2024)  Flavoured dairy milk: 7.0 g/100 mL or 10% reduction for products with total sugar content significantly > 7.0 g/100 mL (2018-2023) |

U.S., United States; U.K., United Kingdom; UNESDA, Union of European Soft Drinks Associations

\*refers to the National Salt and Sugar Reduction Initiative, a partnership of over 100 state and local health authorities and national health organizations from across U.S., convened by the New York City Department of Health and Mental Hygiene (NYC Health Department) to encourage voluntary corporate commitments to sugar and salt reduction targets. These targets are not endorsed nor supported by the U.S. government.

**Online Supplemental Table 3 –** Functions of sugars in foods and functional replacement alternatives

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| --- | --- |
| **Functions** | **Alternatives** |
| *Sweetness* | Non-nutritive or low-calorie sweeteners such as maltitol and sucralose |
| *Water retention* | Humectants and stabilizers such as sorbitol and maltitol |
| *Colour formation* | Artificial and natural food colourants |
| *Flavour (enhancement)* | Natural and artificial flavouring, flavour enhancers, and non-nutritive or low-calorie sweeteners such as maltitol, isomalt, and sucralose |
| *Fermentation* | Leavening agents and acids such as sodium bicarbonate |
| *Texture and bulk* | Gels, gums, starches, and stabilizers such as xanthan gum, modified starch, and agar |
| *Preservation* | Preservatives such as organic acids and antioxidants |

Table adapted from Goldfein and Slavin [11], Jorge [12], Petković [13], Stich [14], Saraiva *et al.* [15], Zeece [16], Khubber *et al.* [17], da Silva Costa *et al.* [18], Saha and Bhattacharya [19], and García-García and Searle [20]

**Online Supplemental Table 4 –** Examples of ingredients lists for full sugar *vs.* low sugar products

|  |  |  |
| --- | --- | --- |
|  | **Full sugar version** | **Low sugar version** |
| *Strawberry yoghurt* | aCultured Grade A Low Fat Milk, Sugar, Strawberries, Modified Food Starch, Water. Contains 1% or less of: Corn Starch, Tricalcium Phosphate, Carmine (for color), Pectin, Natural Flavor, Kosher Gelatin, Vitamin A Acetate, Vitamin D3. | bCultured Grade A Nonfat Milk, Strawberries, Water, Modified Corn Starch, **Allulose**, **Kosher Gelatin**, Citric Acid, Tricalcium Phosphate, Natural Flavor, **Sucralose**, **Potassium Sorbate**, **Acesulfame Potassium**, Red #40, Vitamin A Acetate, Vitamin D3. |
| *Chocolate chip cookies* | cWheat Flour (Wheat Flour, Calcium Carbonate, Niacin, Iron, Thiamin), Chocolate Chips (25%) (Sugar, Cocoa Mass, Vegetable Fats (Sustainable Palm, Shea, Sal), Emulsifiers (Soya Lecithin, E442, E476), Cocoa Butter, Flavourings), Sugar, Sustainable Palm Oil, Whey or Whey Derivatives (Milk), Partially Inverted Sugar Syrup, Raising Agents (Sodium Bicarbonate, Ammonium Bicarbonate), Salt, Flavourings | dWheat Flour (Wheat Flour, Calcium Carbonate, Niacin, Iron, Thiamin), Chocolate Chips with Sweetener (20%) (**Sweetener (Maltitol)**, Cocoa Mass, Emulsifier (Soya Lecithin), Fat Reduced Cocoa Powder, Flavouring), **Sweetener (Maltitol)**, Sustainable Palm Oil, Flavourings, Raising Agents (Sodium Bicarbonate, Disodium Diphosphate, Ammonium Bicarbonate), Salt, Colour (Paprika Extract) |
| *Caramel snack bar* | eMilk Chocolate (40%)(Sugar, Cocoa Butter\*\*, Dried Whole Milk, Cocoa Mass\*\*, Milk Sugar, Sweet Whey Powder (Milk), Emulsifier (Soya Lecithins), Salt, Vanilla Extract), Sugar, Glucose Syrup, Palm Fat, Condensed Skimmed Milk, Barley Malt Extract, Dried Skimmed Milk, Fat Reduced Cocoa Powder\*\*, Caramelised Sugar Syrup, Salt, Dried Egg White | fMilk Chocolate with Sweetener 20.8% (**Sweetener (Maltitol)**, Cocoa Butter, Whole Milk Powder, Cocoa Mass, Emulsifier (Soy Lecithin), Flavourings), Caramel Flavoured Layer 15% (**Bulking Agent (Polydextrose)**, Soy Oil, **Sweeteners (Xylitol, Sucralose)**, Skimmed Milk Powder, Soy Protein, Flavourings, Emulsifier (Soy Lecithin), Salt), **Humectant (Glycerol)**, Soy Protein, **Bulking Agent (Polydextrose)**, Hydrolysed Wheat Gluten, Milk Protein, **Hydrolysed Collagen**, Cocoa Butter, Milk Fat, Sunflower Oil, Cocoa Mass, Emulsifier (Soy Lecithin), Flavourings, **Sweetener (Sucralose)** |

Ingredients used to replace sugar’s function are highlighted in bold

a<https://www.yoplait.com/products/original-single-serve-strawberry>

b<https://www.yoplait.com/products/light-single-serve-strawberry>

c<https://www.tesco.com/groceries/en-GB/products/293418761>

d<https://www.tesco.com/groceries/en-GB/products/311952250>

e<https://www.tesco.com/groceries/en-GB/products/300876915>

f<https://www.tesco.com/groceries/en-GB/products/309781879>

**Online Supplemental Table 5** – The nutritional profile of low (< 5 g per 100 g/100 mL) *vs*. high (≥ 5 g per 100 g/ 100 mL) sugar yogurt and yogurt drinks

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| --- | --- | --- | --- |
| **Nutrient (per 100 g or 100 mL)** | **Low sugar products** | **High sugar products** | ***p* value** |
| *n* | 48 | 281 | - |
| Energy (kJ) | 345 ± 182 | 413 ± 218 | 0.042 |
| Protein (g) | 4.8 ± 2.6 | 3.8 ± 1.6 | < 0.001 |
| Total fat (g) | 4.9 ± 5.2 | 2.8 ± 2.4 | < 0.001 |
| Saturated fat (g) | 3.4 ± 4.5 | 1.8 ± 1.8 | < 0.001 |
| *Trans-*fat (g) | 0.1 ± 0.2 | 0.0 ± 0.1 | 0.033 |
| Carbohydrates (g) | 4.9 ± 1.4 | 13.9 ± 10.1 | < 0.001 |
| Total sugar (g) | 3.2 ± 1.6 | 12.0 ± 5.9 | < 0.001 |
| Free sugar (g) | 0.1 ± 0.5 | 7.2 ± 6.1 | < 0.001 |
| Fibre (g) | 0.6 ± 0.8 | 0.7 ± 0.8 | 0.630 |
| Sodium (mg) | 49.3 ± 29.2 | 86.1 ± 534.8 | 0.634 |
| aHealth Star Rating | 3.7 ± 1.5 | 2.9 ± 1.1 | < 0.001 |

aThe Health Star Rating is a front-of-package nutritional rating system used by the Australian government, with possible points from 0.5 to 5.0 in 0.5 points increments

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