

Sugar functionality and the reformulation challenge



Dr. Julian Cooper
Head of Food Science



ABSugar

Background

Obesity is a complex multifactorial issue

It is a result of over consumption of calories and our increasingly sedentary lifestyle

Singling out any single ingredient, in this case sugar, as a lead cause of obesity is misleading and confusing for consumers

Obesity is increasing – sugars 'consumption' is declining

We all have a role to play in managing the calories in our diets

We in the food industry have a key role to play

Reformulation is one of the routes we can use – **However**, it must deliver a reduction in calories

Sugar is not salt – it is used in different amounts, provides structure and other functions

Stepwise reduction may give unintended consequences

Sugar functionality & reformulation challenge

1. What is Sugar?
2. Sugar functionality
3. Unique functionality
3. How can the functionality be replaced
4. Reformulation considerations
5. What do consumers expect?



What is sugar?

- Carbohydrates $C_x(H_2O)_y$ (-oses)
- Single units (mono-)
 - glucose, fructose, galactose
- Two units (di-)
 - sucrose, maltose, lactose
- More Units (3 – 10) (oligo-)
 - fructo-oligosaccharides
- Lots of Units (poly-)
 - starch, pectin, fibre

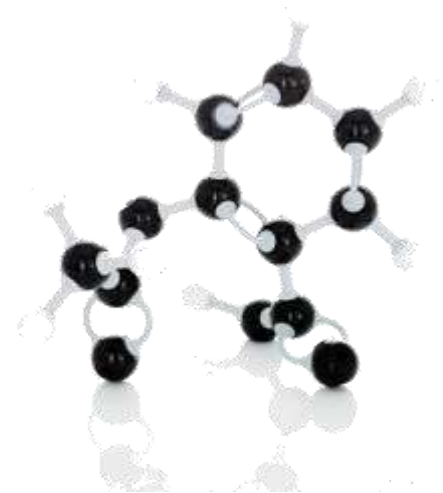
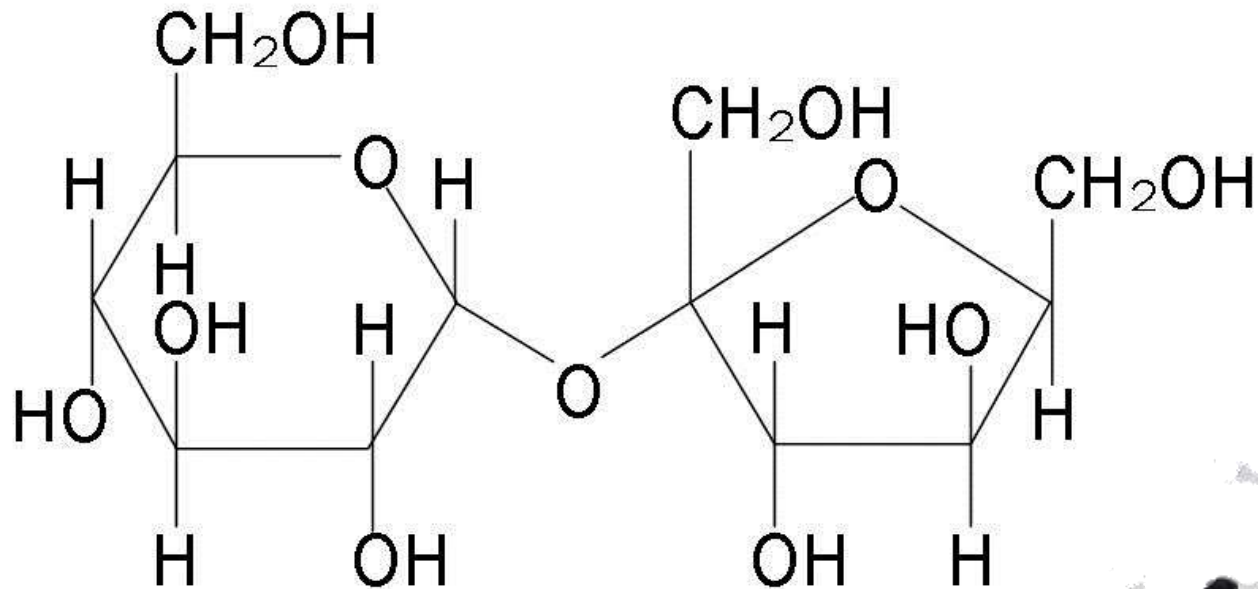
‘SUGARS’



Sugars are not just sugar

What is sugar?

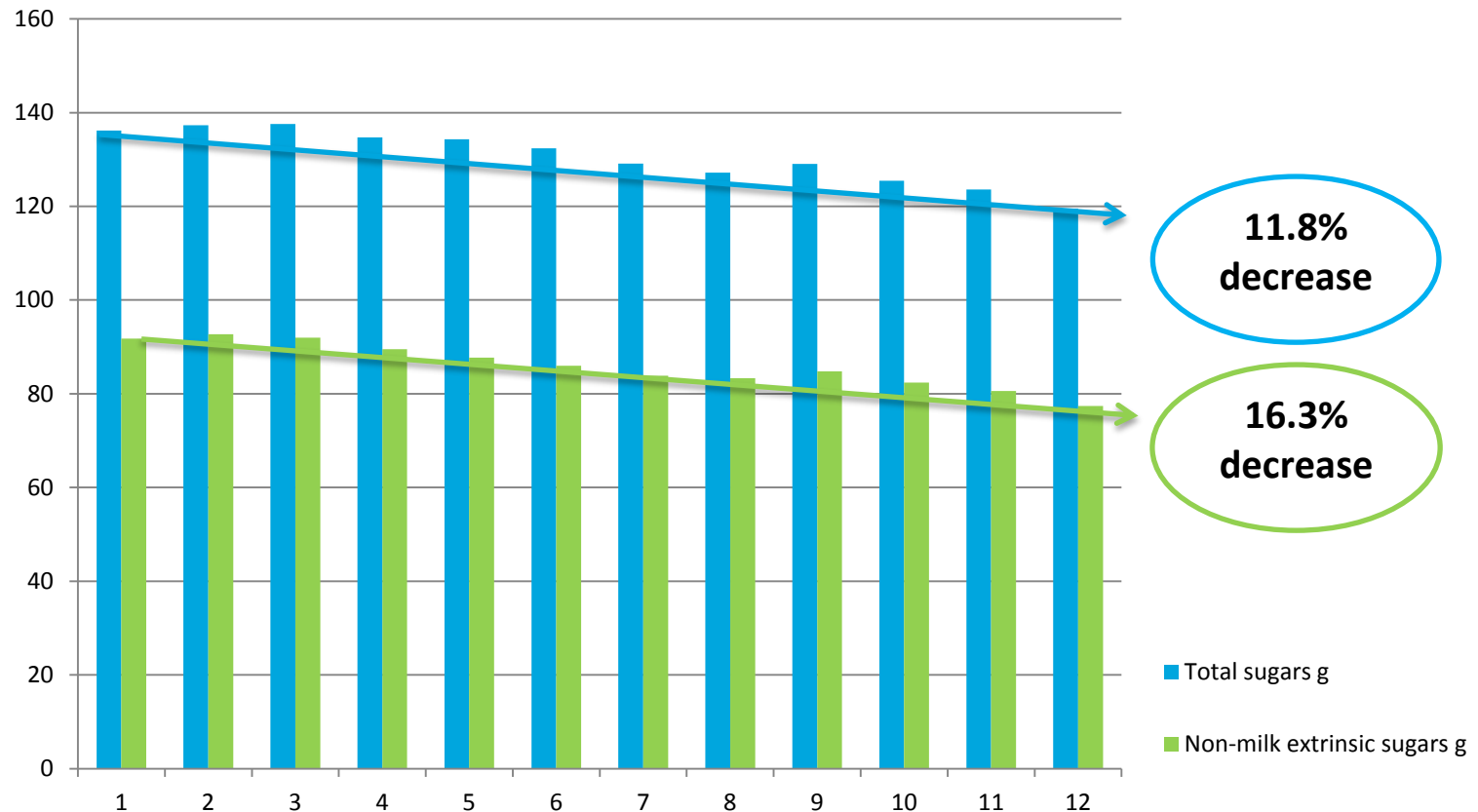
α -D-Glucopyranosyl- β -D-fructofuranoside



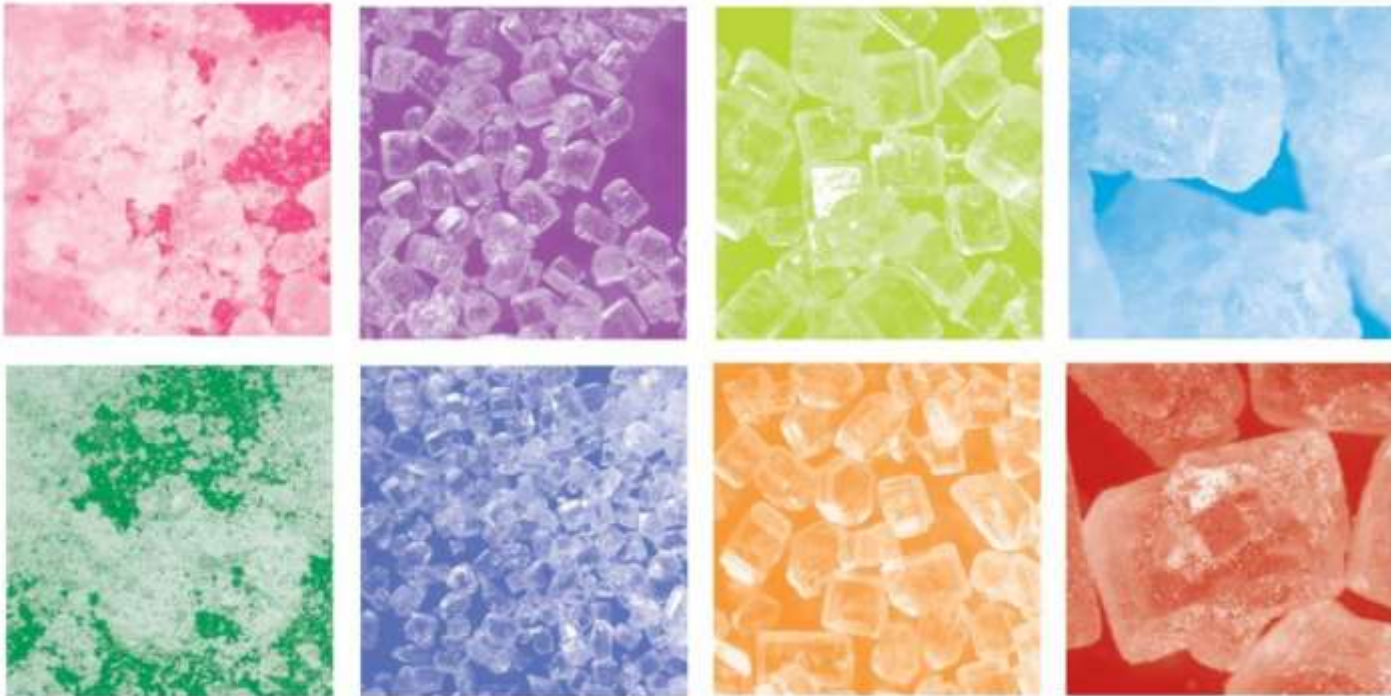
Sugars purchased

Sugar 'consumption' is decreasing:

- Government (DEFRA) Family Food Statistics (2001 – 2012)
- Total Sugars & NMES (g/day)



Functionality of sugar



Functionality of sugar

- Structure
- Sugar provides structure in products – e.g. cakes, biscuits, cereals, preserves and confectionery
- Texture
- Particle size is important
- Texture in fudge, snap in biscuits



Functionality of sugar

- Colour and flavour formation
- Caramelisation
 - Action of heat on sugars
- Maillard reaction
 - Reaction between sugars and proteins
- Traditional colour and flavour generated in baking and processing



Functionality of sugar

- Fermentation substrate
 - Broken down by yeasts to give alcohol and carbon dioxide - bread
- Preservative
 - Dissolves readily – high osmotic pressure
 - Jams, preserves, chutneys
 - Food safety
 - Extends shelf life

Functionality of sugar

- Sweetener
- Sucrose is the 'Gold Standard' for sweetness
- All sugars and sweeteners compared with it
- Relative sweetness of sugars
 - Fructose 1.2; Sucrose 1.0; Glucose 0.7; Lactose 0.4
- Profile of sweetness just as important as the intensity



Unique functions of sucrose

- Sweetness synergy with fructose
 - Produced in situ – more sweetness
- Amorphous/crystalline transition
 - Change of taste/texture in chocolate
- Dual transport mechanism – sports nutrition
 - Two routes to get energy

What does sugar bring?

- Recognised, natural, traditional ingredient
- Multifunctional
- Clean label – sugar
- 4 calories/g (cf fat 9 calories/g)
- Medium glycaemic index (65)



Why Reformulate?

Replace/reduce certain ingredients

Develop 'functional' products

Provide choice for consumers

Develop new products - innovation

Reduce energy density in products

Reduce calories in products

Sugar Reformulation – What can I use?

- Sweetness → High intensity sweeteners, polyols
- Mouthfeel/Texture → Hydrocolloids, polyols, sugars
- Structure → Bulking agents, polyols, fibres
- Colour → Colours
- Flavour → Flavours
- Stability/Preservation → Benzoates etc
- Humectancy → Polyols



Considerations when replacing sugar

- Multiple ingredients
- Increased labelling/warnings
- Gastro-intestinal consequences
- Food safety may be compromised
- Reducing sugar may increase calories (energy density)
- Taste and Consumer acceptance (manufacturer)



Increased Energy Density (Calories/100g)

Regular cake			'Cal reduced' cake	
Wt(g)	cals	Ingredient	Wt(g)	cals
100	900	Fat	100	900
100	400	Sugar	50	200
100	400	Flour	100	400
300	1700	Totals	250	1500

Increased Energy Density (Calories/100g)

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Wt(g)	cals	Ingredient	Wt(g)	cals
100	900	Fat	100	900
100	400	Sugar	50	200
100	400	Flour	100	400
300	1700	Totals	250	1500
	567			600

Calories increase/100g

Stepwise Reduction

Shortbread recipe

Butter 110g; Flour 175g; Caster sugar 50g

Weight of sugar g	'Calories reduced'	Sugar g/100g	
50	0	14.9	
45	20	13.6	
40	40	12.3	
35	60	10.9	

'Calories reduced' = wt of sugar removed x 4cals

Stepwise Reduction

Stewise sugar reduction					
Shortbread					
Recipe		Fat g	Carb g	Protein g	Sugars g
Butter	110	88			
Flour	175		122.5	17.5	
Sugar	50		50		50
% composition		26.3	51.5	5.2	14.9
Total Recipe Wt g	335				
Calories		792	690	70	
Total Cals	1552				
Cals/100g	463				

Stepwise Reduction

Shortbread recipe

Butter 110g; Flour 175g; Caster sugar 50g

Weight of sugar g	'Calories reduced'	Sugar g/100g	Actual Calories/100g
50	0	14.9	463
45	20	13.6	464
40	40	12.3	465
35	60	10.9	466

'Calories reduced' = wt of sugar removed x 4cals

Reduced Sugars – Consumer Expectations

‘Reduced Sugar’ products



Product	Sugar g/100g	Energy cal/100g	Salt g/100g	Fat g/100g
Regular Sugar coated Product	37	371	1.15	0.6
‘Reduced Sugar’ Product	25	369	1.4	0.6
Regular Product	8	373	1.75	0.9

Consumer Expectations

- Research at Leatherhead Food Research
 - Consumer focus groups and web questionnaire
 - Good awareness of product claims eg 'no added sugars' etc
 - Little awareness of the level of reduction or the associated calorie reduction
 - Expect a reduction in sugar content to deliver a reduction in calorie content
 - Consumer confusion around calorie content of different nutrients
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- Ref: Consumer understanding of sugars claims on food and drink products N J Patterson, M J Sadler & J M Cooper. British Nutrition Foundation Nutrition Bulletin **37**, 121 – 130, 2012

Summary

- **Sugar - natural, traditional, multifunctional ingredient**
- **Sugars are not just sugar**
- **Singling sugar out as only cause of obesity is misleading**
- **There is no 'silver bullet' to solve obesity**
- **Sugars 'consumption' is declining**
- **Reformulation must deliver a reduction in calories**
- **Stepwise reduction may have unintended consequences**
- **Sugar is not salt**



THANK YOU

Julian.cooper@absugar.com