



# The Role of Ingredients to Reduce the GI value

Pauline Taggart



***National Starch***  
FOOD INNOVATION

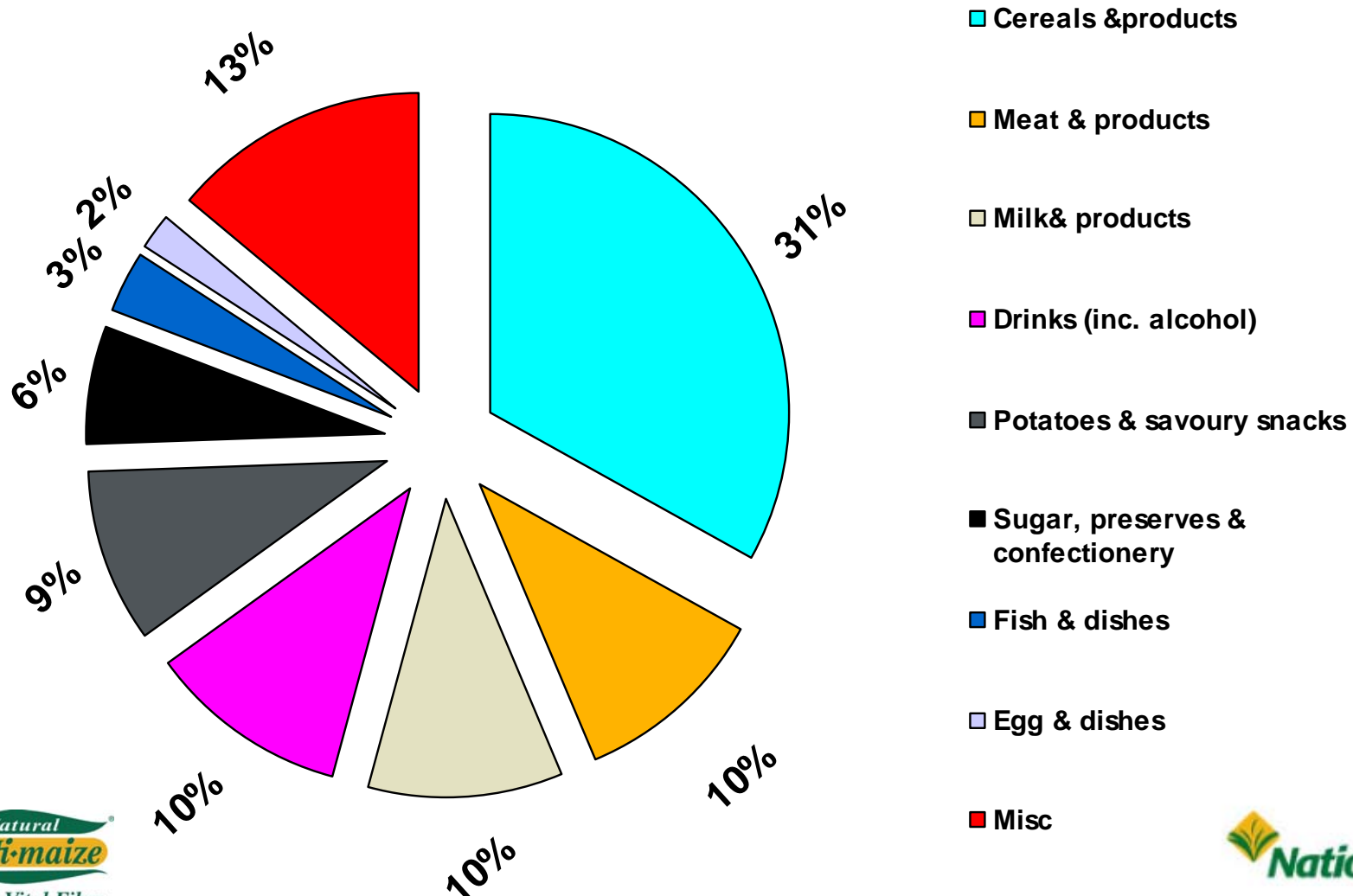
**Glycaemic Index: Future Opportunities**  
**Food & Health Briefing Series**  
**Wednesday 29<sup>th</sup> June: SCI London**

# Ingredients for Glycemic Impact

- **Carbohydrates**
  - Classification of carbohydrates
  - Lower GI
  - Lower GR
  - Effect of processing
- **Protein**
- **Fat**
- **Organic Acids**

# Carbohydrate Quality becoming more important

Cereal-based products provide 1/3 of our energy intake



# The WHO/FAO Consultation recommends:



WHO/FAO Expert Consultation on Carbohydrate Nutrition, 1997

1. That the concept of glycemic carbohydrate, meaning “providing carbohydrate for metabolism” be adopted.
2. Against the use of the terms extrinsic and intrinsic sugars, complex carbohydrate and available and unavailable carbohydrate.’

# Classification of Carbohydrate

## (i) Classification according to chemical structure

Class (DP)	Sub-Group	Components
<b>Sugars (DP 1-2)</b>	Mono-saccharides	Glucose, fructose, galactose
	Di-saccharides	Sucrose, lactose, trehalose
	Polyols (sugar alcohols)	Sorbitol, mannitol, erythritol, maltitol, xylitol, lactitol
<b>Oligo-saccharides (DP 3-9)</b>	Malto-oligosaccharides	Maltodextrins
	Other Oligosaccharides	Raffinose, stachyose, fructo-oligosaccharides
<b>Poly-saccharides (DP &gt; 9)</b>	Starch	Amylose, amylopectin, modified starches, pyro-dextrins
	Non-starch poly-saccharides	Cellulose, hemicellulose, pectins, beta-glucan, fructans, gums, mucilages, algal polysaccharides, other hydrocolloids, polydextrose

Source: Joint FAO/WHO Expert Consultation, Rome, 14-18 April 1997 & amendments

# Classification of Dietary Carbohydrate

SUGARS			STARCH		RESISTANT OLIGO-SACCHARIDES	NSP	
POLYOLS	FRUCTOSE SUCROSE LACTOSE MALTOSE	FREE SUGAR GLUCOSE	DIGESTIBLE STARCH				RESISTANT STARCH
		GLYCEMIC GLUCOSE					
		RAG	SAG				
NGC	GLYCEMIC CARBOHYDRATE			NON- GLYCEMIC CARBOHYDRATE (NGC)			

Wolever et al 2005

## 2 Strategies for NPD

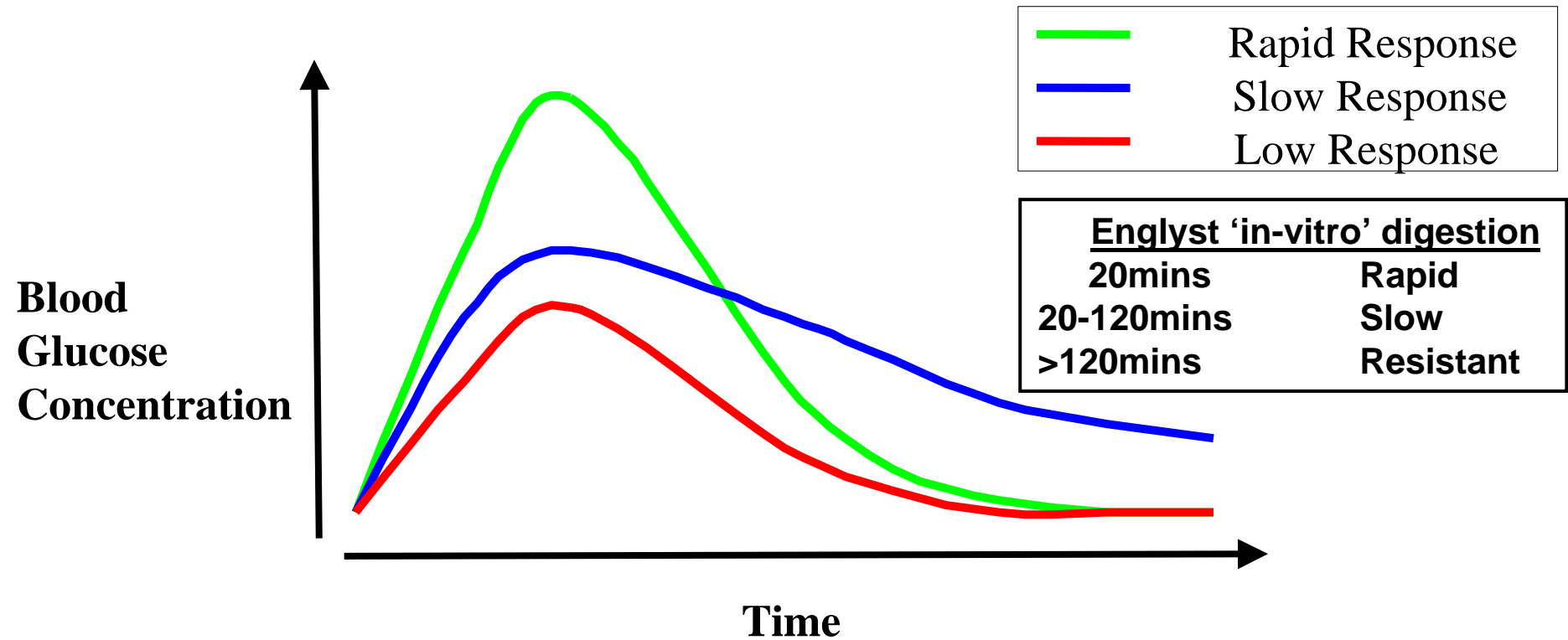


- Change glyceemic carbohydrate 'make-up'
- Replace glyceemic carbohydrates with NGC

# GI Values of Carbohydrates?

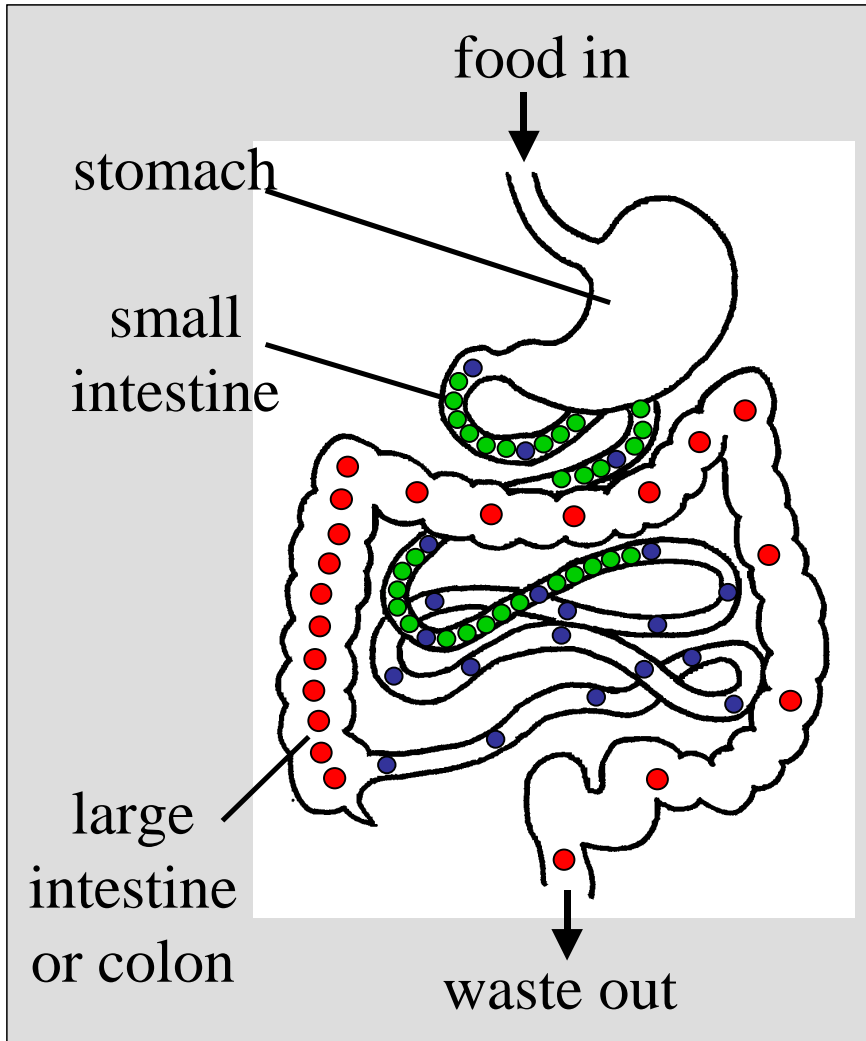
TYPE	INGREDIENT	GI*	
Mono-saccharide	Glucose (G)	99 ± 3	'available'
	Fructose (F)	19 ± 2	
Di-saccharide	Maltose (G-G)	105 ± 12	'available'
	Lactose (Gal-G)	46 ± 2	
	Sucrose (G-F)	68 ± 5	
Sugar alcohols	Lactitol	2 ± 3	'non-available'
	Xylitol	8 ± 1	
	Maltitol <sup>2</sup>	34 ± 4	
Polysaccharide <sup>2</sup>	Polydextrose	4-7 ± 2	'non-available'
Glucose + Gum	Apple/orange fibre	79 ± 3	'non-available'

# Lower GI by inter-changing 'glycemic carbohydrate' profile

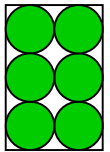


Glycemic Index claims validated through in-vivo testing (clinical)  
Englyst 'in-vitro' digestion method used in research to validate carbohydrate quality

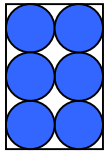
# Lower Glycemic Response by replacing 'Glycemic Carbohydrates' with 'resistant carbohydrates'



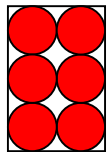
*Rapidly digested*



*Slowly digested*

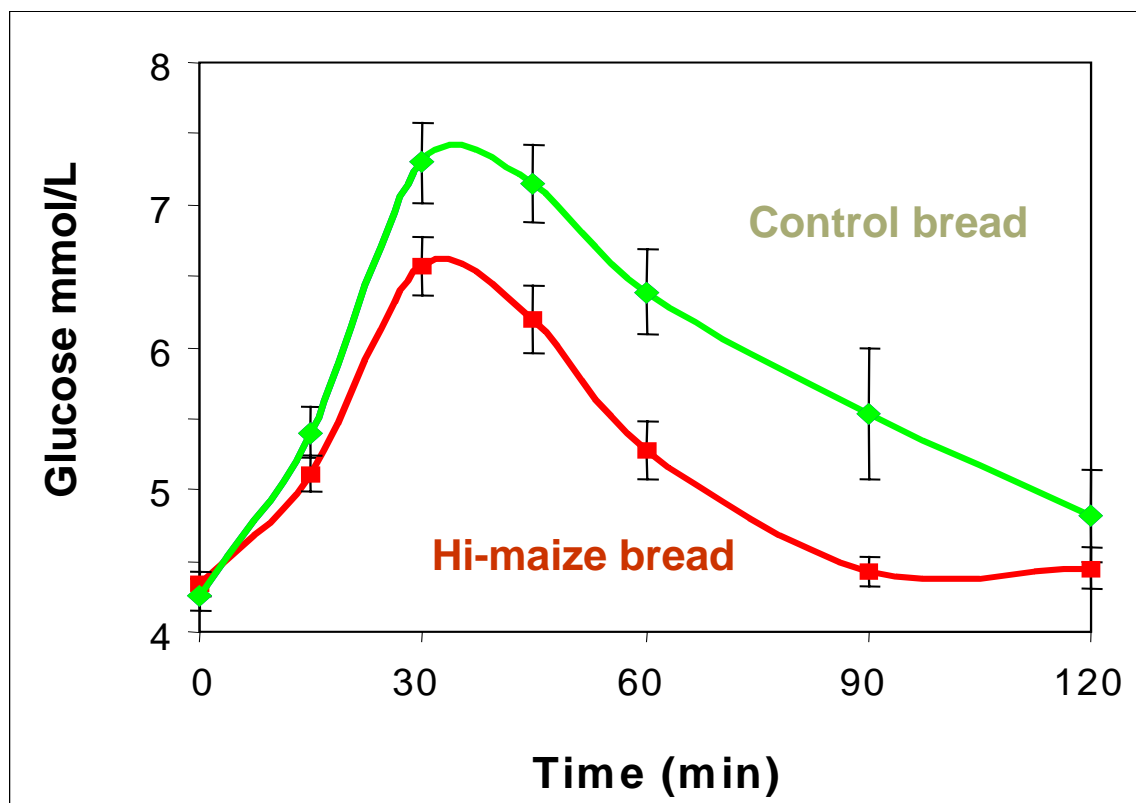


*Resistant*



- ✓ Re-balance our diets with a more balanced carbohydrate profile

# Resistant Starch Lowers Glucose Response



- Replacing flour in bread with high amylose resistant starch reduced the post-prandial plasma glucose response by 45%

10 healthy subjects; 100 g bread & 50 g CHO consumed from control or test bread. GI Testing Inc., Canada

# Factors Influencing Starch Digestion

<b>Amount of starch eaten</b>	
<b>Nature of the Starch</b>	amylose content granularity conformation
<b>Food processing</b>	processing conditions extent of gelatinisation cellular structure particle size other food components – antinutrients customs of food preparation & consumption
<b>Physiology</b>	health status individual physiological differences extent of chewing gastric emptying intestinal transit fibre impact

# Processing Effects on Carbohydrate and GI

TYPE	GI*
Bread, white wheat flour	70
Bread, wheat with 50% cracked wheat kernels	58
Bread, wheat with 75% cracked wheat kernels	48
Oat porridge, thin roasted steamed dehulled oat flakes	80
Oat porridge, thin roasted dehulled oat flakes	69
Oat porridge, thick roasted dehulled oat flakes	50
Rice, long grain boiled for 10 min	61
Rice, long grain boiled for 5 min	38

# Carbohydrate - Summary

- **Non-glucose sugars**
- **Whole grains**
  - Reduced processing
- **Starches**
  - Select cereal types
  - Reduce gelatinisation
  - Protect by a network
- **Gums**
  - Viscosity
- **Indigestible Carbohydrates**
  - High amylose resistant starch
  - Polydextrose, inulin, wheat fibre ...

✓ **Food structure & holistic food design is more important than individual ingredient choice**

# Dietary Goals & Recommendations

## UK Dietary Intakes

	DRV	INTAKE	
		Male (ave)	Female (ave)
Total Carbohydrate, g		275	203
<b>Fibre (NSP, g)</b>	<b>18</b>	<b>15.2</b>	<b>12.6</b>
Extrinsic Sugars, g		79	51
CHO, %E	47/50	47.7%	48.5%
Non milk extrinsic sugar, %E	10/11	13.6	11.9
Energy, kJ		9.72	6.87
Energy, % of EAR		92	85
<b>% of people with &lt;18g NSP</b>		<b>72</b>	<b>87</b>

- of the CHO related recommendations, fibre is the furthest from the DRV
- sugar intakes are high, and have already been targetted by the FSA

# Non-Carbohydrate Ingredients

## • Protein <sup>1</sup>

- Some proteins promote insulin release
  - e.g. gelatin, which is rich in glycine
- Satiating role
  - e.g. whey > casein
- Soya
  - Health benefits

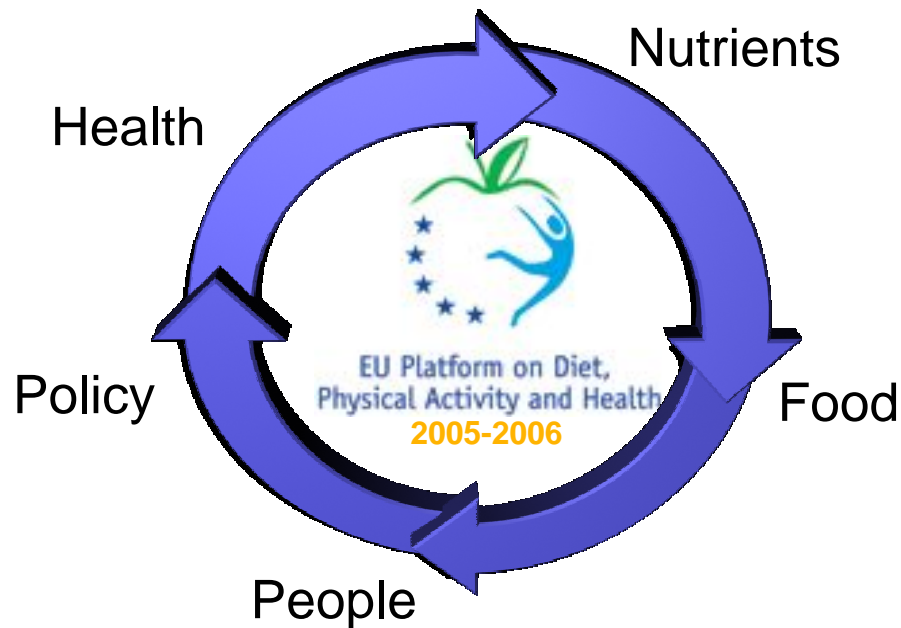
## • Fat

- Slow gastric emptying

## • Organic Acids <sup>2</sup>

- Slow gastric emptying
- e.g. Wholemeal barley flour bread GI = 70  
Wholemeal barley flour bread with sourdough (lactic acid) GI = 53

# New strategies will be 'holistic', science-based and focus more on 'prevention'



Solution  $\neq$  Ingredient GI nor  $\neq$  GI product  
but may = GI/GR meal within context of Lifestyle

# Ingredient Selection Criteria – ‘HOLISTIC’

- **Tolerance – especially in staple foods**
  - Remember the power users – your best customers!
- **Does it impact taste or texture?**
  - Consumers will not accept compromises on taste, texture & convenience
- **Process tolerance**
  - Does it impact the manufacturing process?
- **Scientifically proven**
  - Clinical data based on multiple human intervention studies
- **Is it natural? Will consumers buy it?**
  - Fit to nutritional positioning & fit to a wholesome diet
  - Is it something that our bodies are designed to eat?
- **Cost-effectiveness**

✓ **Some compromises may be required ...  
key is to focus on consumer-valued benefits**

[www.foodinnovation.com](http://www.foodinnovation.com)

[www.carbohydratenutrition.com](http://www.carbohydratenutrition.com)

[www.hi-maize.com](http://www.hi-maize.com)

A woman with blonde hair is shown in profile, smelling her open palm. Several stylized, light green leaves are floating above her hand, suggesting a natural or fresh scent. The background is a solid green color.

Thank you  
for your attention