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TODAY'S DISCUSSION AND LEARNING OBJECTIVES

- The world of carbs is expanding
  - Gain awareness of newer carbohydrates and understand how they fit into the spectrum of carbohydrate types.
- Different carbs, different outcomes in the body
  - Be able to compare the general molecular structure of different types of carbohydrates and explain how structure affects digestion and absorption.
- Introducing isomaltulose (Palatinose™) and its health impacts
  - Describe the positive and negative metabolic impact among different types of carbohydrates, including isomaltulose.
- Helping consumers understand sugars and carbs on the label
  - Recognize the complexities of educating consumers on added sugars on the label, in light of the unique features of newer carbohydrates.

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THE WORLD OF CARBS AND SUGARS IS EXPANDING

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CARBOHYDRATES

Categories:

- Occur in the form of sugars, oligosaccharides, starches, polyols and fibers

Fuel for the body:

- One of 3 macronutrients for energy supply (along with fat and protein)
- Source of glucose (main energy source for brain and working muscles)

Intake recommendations:

- Based on dietary guidance on protein and fat, more than half of the daily energy intake comes from carbohydrates

Role in food applications:

- Provide nutrition, sweetness, taste, texture, appearance to foods

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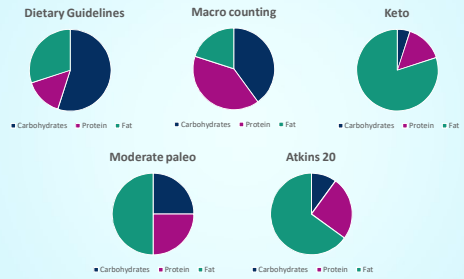
MACRONUTRIENT DISTRIBUTION IN POPULAR DIETS



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STRUCTURAL CLASSIFICATION OF CARBOHYDRATES

Class (DP*) and subgroup	Examples
Sugars (1-2)	
Monosaccharides	Glucose, galactose, fructose, tagatose
Disaccharides	Sucrose, lactose, trehalose, maltose, isomaltulose
Oligosaccharides (3-9)	
Maltooligosaccharides	Maltodextrins
Other oligosaccharides	Fructooligosaccharides (FOS), galactooligosaccharides (GOS), raffinose, stachyose
Polysaccharides (>9)	
Starch	Amylose, amylopectin, modified starches, resistant starch
Non- starch polysaccharides	Celluose, hemicelluloses (e.g. arabinoxylans), pectins, inulin, hydrocolloids (e.g. guar), beta-glucan
Hydrogenated carbohydrates (polyols)	
Monosaccharide type	Sorbitol, mannitol, xylitol, erythritol
Disaccharide type	Isomalt, lactitol, maltitol
Oligosaccharide type	Maltitol syrups, hydrogenated starch hydrolysates (HSH)

*DP= Degree of polymerization
Source: Adapted from FAO/WHO Expert Consultation (1998)Carbohydrates in human nutrition(Concise Monograph Series ILSI

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DIFFERENT CARBS, DIFFERENT OUTCOMES

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CARBOHYDRATES - THINKING BEYOND CLASSICAL STRUCTURAL CATEGORIES...

Sugars (DP 1-2)		
	Isomaltulose	**Sucrose**
Chemical structure	Disaccharide (DP 2)	Disaccharide (DP 2)
Kind to teeth	Yes	No
Digestible	Yes	Yes
BGR[1] / GI	Slow /low GI	Fast/ medium to high GI
Colon fermentation	No	No
Energy[2] [kcal/g]	4	4
Nutrition labelling	Sugar	Sugar

1 BGR: Blood glucose response
2 Caloric value for food labelling in the U.S.

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CARBOHYDRATES - THINKING BEYOND CLASSICAL STRUCTURAL CATEGORIES...

Oligosaccharides (DP 3-9)		
	Maltodextrin	**Fructooligosaccharides (FOS)**
Chemical structure	Oligosaccharide (DP 3-9)	Oligosaccharide (DP 3-9)
Kind to teeth	No	Yes
Digestible	Yes	No
BGR[1] / GI	Fast / high GI	No BGR (GI not applicable)
Colon fermentation	No	Yes
Energy[2] [kcal/g]	4	2
Nutrition labelling	Carbohydrate	Fiber

1 BGR: Blood glucose response
2 Caloric value for food labelling in the U.S

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CARBOHYDRATES - THINKING BEYOND CLASSICAL STRUCTURAL CATEGORIES...

Disaccharides (DP=2)		
	Sucrose	**Isomalt**
Chemical structure	Disaccharides (DP=2)	Hydrogenated disaccharide (DP=2)
Kind to teeth	No	Yes
Digestible	Yes	Partially
BGR[1] / GI	Fast/ medium to high GI	Very low BGR (GI not applicable)
Colon fermentation	No	Yes- partial
Energy[2] [kcal/g]	4	2
Nutrition labelling	Sugar	Sugar Alcohol

1 BGR: Blood glucose response
2 Caloric value for food labelling in the U.S.

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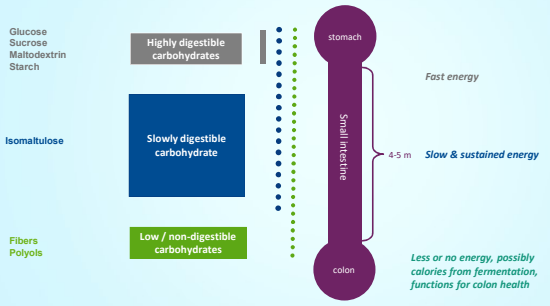
CARBOHYDRATES IN THE SMALL INTESTINE
SITE OF DIGESTION AND ABSORPTION



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WHY BALANCED BLOOD SUGAR MATTERS FOR ALL

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A CLOSER LOOK AT ISOMALTULOSE (PALATINOSE™): A DIFFERENT TYPE OF CARB

SUSTAINED ENERGY
LOW BLOOD GLUCOSE RESPONSE
HIGHER LEVEL OF FAT BURNING
SPORTS NUTRITION
WEIGHT MANAGEMENT
COGNITIVE AND MOOD

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INTRODUCING ISOMALTULOSE (PALATINOSE™)
A DIFFERENT TYPE OF CARBOHYDRATE

Isomaltulose is a **"slow release" carbohydrate**:
It supplies the body with **the full carbohydrate energy** in a slower, more balanced way and over a longer period of time than conventional carbohydrates.

- Like sucrose, composed of glucose and fructose
- Naturally found in honey
- Produced via rearrangement of sucrose

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STRONGER LINKAGE IMPACTS EFFECTS

Palatinose™

Slow and sustained energy	Low blood glucose response	Higher level of fat burning	Sports nutrition	Weight manage-ment	Cognition and mood	Tooth-friendly

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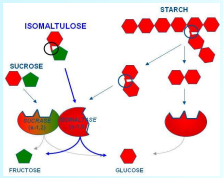
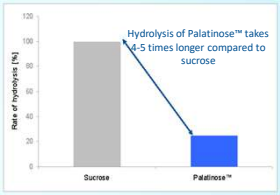
SLOWER DIGESTION IN THE SMALL INTESTINE



Scheme of hydrolysis of sucrose, starch & Palatinose™ in the small intestine



Palatinose™ is hydrolyzed at the same enzyme complex as is involved in the digestion of sucrose and starch*
It is digested at the isomaltase site.

* The amylopectine derived glucose-glucose 1-6 linkage

Rate of hydrolysis – sucrose vs. Palatinose™ from *in vitro* enzyme kinetic studies

Grupp & Siebert, 1978, Res Exp Med 173, 261-278.

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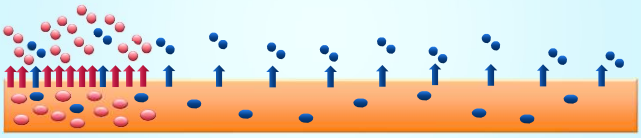
FAST VERSUS SUSTAINED ENERGY

Sucrose
- Early and fast intestinal release
- Complete use as energy source

⇒ "Fast energy"

Palatinose™
- Slow intestinal release along entire length
- Complete use as energy source

⇒ "Sustained energy"



Small intestine of 4-5 m length
Sucrose Palatinose™

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INCRETINS: GUT HORMONES THAT ARE PIVOTAL FOR METABOLIC HEALTH

Incretins are a special group of gastrointestinal hormones that stimulate glucose-dependent insulin secretion. Recognized substances are:

GIP

- Glucose-induced insulinotroptic peptide
- Release from K-cells in the upper part of the small intestine
- Stimulated by fast glucose uptake from dextrose or rapidly digested carbs (e.g. sucrose, processed starch)
- Early insulin response to glucose
- Metabolic regulation after food intake for effective energy storage

GLP-1

- Glucagon-like peptide-1
- Release from L-cells in the lower part of the small intestine and in the colon
- Stimulated by carbohydrates and other nutrients
- Later insulin response to food
- Signals to inhibit gastric emptying and reduce food intake

Baggio L., Drucker D.J., (2007) Biology of incretins: GLP-1 and GIP; Gastroenterology 132(6) 2131-2157
Gastroenterology 2007 132131-2157DOI: (10.1053/j.gastro.2007.03.054)

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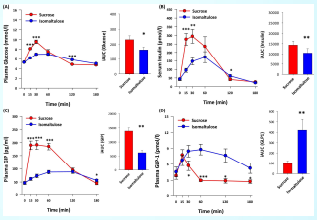
IMPROVEMENT OF METABOLIC HEALTH IN HEALTHY PEOPLE, THOSE WITH TYPE 2 DIABETES

Gut hormones → Growing research area
→ Valuable indicators for the metabolic quality of carbohydrates

Lower GIP release in the upper small intestine

Higher GLP-1 release in the lower small intestine



Intake of 50 g sucrose or isomaltulose (Palatinose™) by 15 healthy humans (aged 38.1 ± 12.9 yrs, BMI 25.1 ±5.02 kg/m2)

Keyhani-Nejad F, et al. Effects of palatinose and sucrose intake on glucose metabolism and incretin secretion in subjects with type 2 diabetes. *Diabetes Care*. 2016; 39: e38-e39

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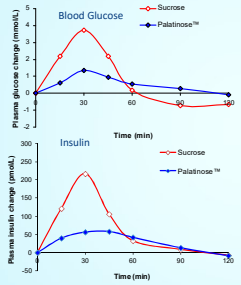
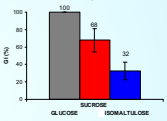
PALATINOSE™ LOWERS BLOOD SUGAR, INSULIN RESPONSES

Lower blood glucose response





THE UNIVERSITY OF SYDNEY

➡ Lower blood glucose response is associated with lower insulin release

Sydney University's Glycaemic Index Research Service (SUGiRS) (2002)
Sponsor: BENEO

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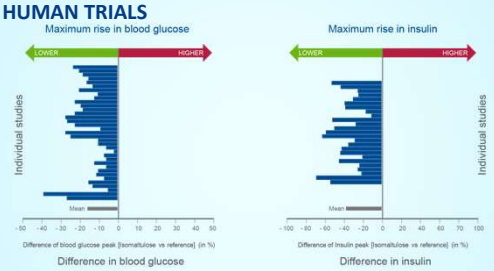
LOWER BLOOD GLUCOSE RESPONSE IN 30+ HUMAN TRIALS

Lower blood glucose response



All studies confirm the lower blood sugar response with Palatinose™

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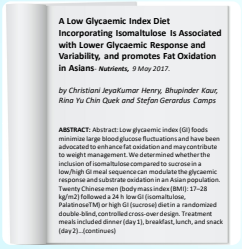
Lower blood glucose response

INCLUDING PALATINOSE™ INTO THE DIET LOWERS THE BLOOD GLUCOSE PROFILE OVER THE DAY



A Low Glycaemic Index Diet Incorporating Isomaltulose Is Associated with Lower Glycaemic Response and Variability, and promotes Fat Oxidation in Asians- ***Nutrients,*** *9 May 2017.*

by Christiani JeyaKumar Henry, Bhupinder Kaur, Rina Yu Chin Quek and Stefan Gerardus Camps

ABSTRACT: Abstract: Low glycaemic index (GI) foods minimize large blood glucose fluctuations and have been advocated to enhance fat oxidation and may contribute to weight management. We determined whether the inclusion of isomaltulose compared to sucrose in a low/high GI meal sequence can modulate the glycaemic response and substrate oxidation in an Asian population. Twenty Chinese men (body mass index (BMI): 17–28 kg/m2) followed a 24 h low GI (isomaltulose, Palatinose™) or high GI (sucrose) diet in a randomized double-blind, controlled cross-over design. Treatment meals included dinner (day 1), breakfast, lunch, and snack (day 2)...(continues)

- Randomized, double-blind, cross-over study comparing low GI diet (Palatinose™) vs. high GI diet (sucrose)
- Over a day profile with sequence of several meals
- Using two continuous monitoring techniques in parallel:
  - Continuous blood glucose monitoring
  - Whole body room calorimeter

Henry et al. (2017) Nutrients 9(5):473. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5452203/pdf

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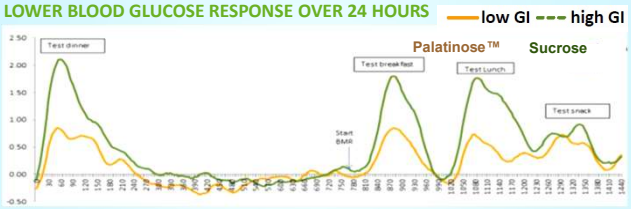
LOW GI DIET INCORPORATING PALATINOSE™ LOWER BLOOD GLUCOSE RESPONSE OVER 24 HOURS

low GI high GI



Inclusion Palatinose™ or sucrose during the test meals:
- 30g with dinner in fruit drink
- 30g with breakfast added to tea
- 20g with lunch in fruit drink
- 20g with snack added to tea

- Lower blood glucose response over 24h (p=0.002)
- Fewer swings in blood glucose levels over 24h (p<0.001)
- Higher fat oxidation (fat burning) after low GI breakfast (p=0.026), lunch (p<0.001), and snack (p=0.013)

Study design: Randomised, double-blind, cross-over study comparing low GI diet (Palatinose™) versus high GI diet (Sucrose) in 20 healthy Chinese men (21-29 years old, BMI: 18-29 kg/m²).

Jeyakumar et al 2017. Nutrients 9:473. Available from http://www.mdpi.com/2072-6643/9/5/473

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Higher level of fat burning

CARBOHYDRATE QUALITY IMPACTS ENERGY METABOLISM

Carbohydrates

Prime fuel for the body

Key driver of energy metabolism

Influence on

Fuel management
for training, fitness, endurance, performance

Energy and fat storage
for body composition and body weight metabolic health

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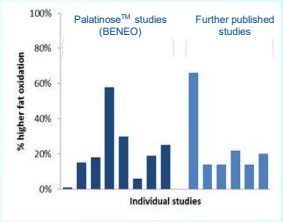
Higher level of fat burning

THE TYPE OF CARBOHYDRATE MATTERS

- Palatinose™ and its more steady and sustained glucose supply allows for a higher fat burning rate in energy metabolism than conventional high glycemic carbohydrates

- Effect of Palatinose™ on fat burning confirmed in different populations:
  - **at rest** and during physical activity
  - trained endurance athletes and **moderately active**
  - People of **normal weight** or **overweight**
  - normal and impaired **glucose tolerance** (IGT)



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Sports nutrition

WHAT DO ATHLETES DO TO MANAGE THEIR FUEL TANKS?

ENDURANCE TRAINING	PREPARING FOR THE EVENT	DURING THE EVENT	RECOVERY
Increasing the body's capacity to **burn fat** and **spare carb sources** (glycogen)	**Carbohydrate loading**: Maximum filling of glycogen stores in the last days before an event	Additional **carb intake** with sports drinks before and during the event	**Refill** of glycogen stores for next training or competition

Carbohydrate choice can make a difference!

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Sports nutrition

PALATINOSE™ IN SPORTS

Series of sports studies with Palatinose™

- In comparison with maltodextrin or sugar
- In trained athletes or recreational sports
- Taken before, during and after exercise

- ✓ More steady glucose supply
- ✓ Sufficient carbohydrate energy
- ✓ Higher rate of fat burning
- ✓ No gastrointestinal distress

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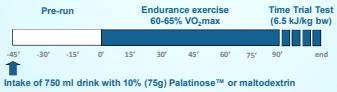
Sports nutrition

STUDY DESIGN: PALATINOSE™ AND PERFORMANCE

- **Purpose**
- Effect of Palatinose™ (low GI) vs. maltodextrin
- (high GI) on substrate use during endurance exercise
- and subsequent time trial performance

- **Study Design**
  - 2-arm cross-over design, randomised, double-blind, placebo controlled
  - N = 20 male endurance athletes (VO_2max > 55 ml/kg)
  - Consumption of a beverage with 75g Palatinose™ or maltodextrin before exercise



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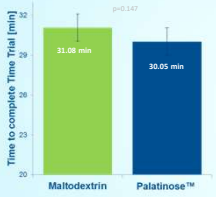
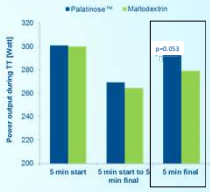
Sports nutrition

ENDURANCE PERFORMANCE

Time to finish the time trial



Power output during the time trial



- Better performance with Palatinose™:
  - ~1 min **faster time trial performance**
  - More subjects faster in TT with Palatinose™

Better performance with Palatinose™:

⇒ Athletes still achieved **a higher power output** during the final 5 minutes of the time trial

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Sports nutrition

KEY FINDINGS FROM KÖNIG ET AL (2016)

- Palatinose™ improved cycling performance (vs. maltodextrin):
  - Faster time to finish time trial
  - Higher power output in the time trial finish
- Palatinose™ provided glucose more steadily with positive influence on fuel use in preceding endurance exercise (vs. maltodextrin)
  - More stable and sustained blood glucose profile
  - Higher fat oxidation rates

Proposed mechanism: Lower carbohydrate oxidation allowed to spare glycogen sources for the final time trial performance.

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Weight management

PALATINOSE™: LONG-TERM EFFECTS ON BODY WEIGHT AND BODY COMPOSITION

Body composition ← palatinose™ *Lower blood sugar & insulin levels & higher fat burning support…* → Body weight

Palatinose™ causes **less fat accumulation**

- in adipose tissue ("belly fat") with benefits on body composition
- in the liver with potential in the prevention of non-alcoholic fatty liver and insulin resistance*

Palatinose™ may be more effective in **promoting weight loss** in a weight loss diet than sucrose

Findings from sugar replacement concepts in long-term human intervention studies or * first animal study

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Weight management

CONTINUOUS REPLACEMENT OF SUCROSE BY PALATINOSE™ AIMING TO SUPPORT WEIGHT LOSS

The continuous replacement of sucrose by Palatinose™ would support body weight loss and favorably impact body composition due to increased fat oxidation

Study design: Randomized, double-blind, placebo controlled
Subjects: 50 adults with overweight or obesity
Product: 40 g/d Palatinose™ vs. 40 g/d sucrose energy-reduced diet (~1700kcal)
Duration: 12 weeks
Parameters: Anthropometrics, body composition, energy intake and energy metabolism

Lightowler et al. (2019) Nutrients 11, 2367. doi: 10.3390/nu11102367; https://www.mdpi.com/2072-6643/11/10/2367
Sponsor: BENEO

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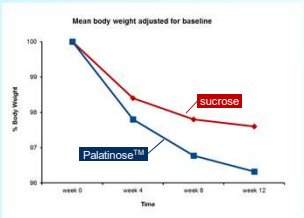
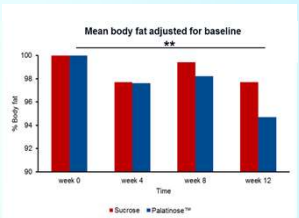
Weight management

PALATINOSE™ REDUCED BODY WEIGHT AND FAT MASS OVER 12 WEEKS





- Both groups significantly lost weight over 12 weeks compared to baseline (p<0,001)
- With Palatinose™ rate of weight loss was faster compared to sucrose

- Over 12 weeks mean% body fat was reduced in both groups
- The change in week 12 from baseline was greater and only significant with Palatinose™ (p=0.005)

Lightowler et al. (2019) Nutrients 11, 2367. doi: 10.3390/nu11102367; https://www.mdpi.com/2072-6643/11/10/2367
Sponsor: BENEO

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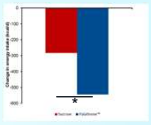
Weight management

PALATINOSE™ INCREASED FAT OXIDATION, REDUCED ENERGY INTAKE

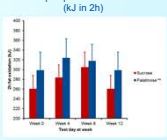
- Energy intake (from 3-day food diaries)
  - Energy intake was significantly reduced in both groups ($p<0.001$)
  - Energy intake in the Palatinose™ group was reduced to a greater extent (-544 kcal/d) than in the sucrose group (-283 kcal/d) ($p = 0.022$)
- In all occasions, fat burning was up to 15% higher with Palatinose™ vs. sucrose
- At week 12, the perceived quality of life was better in the Palatinose™ group than in the sucrose group

Results suggest that Palatinose™, a slow-release and low glycemic sugar alternative, might be a useful tool to promote weight loss and thus improve metabolic risk factors

Change in energy intake at week 12



Estimated postprandial fat oxidation (kJ in 2h)



Lightowler et al. (2019) Nutrients 11, 2367. doi: 10.3390/nu11102367 https://www.mdpi.com/2072-6643/11/10/2367
Sponsor: BENEO

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Cognitive and Mood Benefits

COGNITIVE PERFORMANCE

Complete yet "slow release" carbohydrate energy

Low glycemic profile → Lower, smoother **metabolic profile**

Balanced & prolonged energy for brain → Palatinose™ may enhance **mental performance** and improve **mood**

- Glucose is **the only energy source** for the brain and can **influence cognitive performance**
- Children have a **higher rate of brain glucose utilization compared to adults**- thus more vulnerable to glucose fluctuations
- Not only the intake as such, also the **type of carbohydrate** can make a difference

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Cognitive and Mood Benefits

PALATINOSE™ AND COGNITIVE PERFORMANCE

- 75 school children aged 5-11 years (average ± 8.8 years)
- On two separate days children ate a breakfast
  - with identical levels of energy and macronutrients
  - sweetened with Palatinose™ (GL 32) or glucose (GL 60) (41g)
- Isocaloric breakfast with differences in GL values
  - Palatinose™ breakfast with GL 31.8
  - Glucose breakfast with GL 59.9
- Cognitive performance
  - Immediate, delayed & spatial memory, sustained attention, reaction times, information processing
- Mood assessment

Young and Benton (2015) Eur J Nutr 54(6):1013–1020

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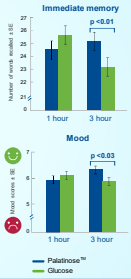
Cognitive and Mood Benefits

PALATINOSE™ AND COGNITIVE PERFORMANCE

Breakfast concept with Palatinose™:

- Replacing high GI carbohydrates like glucose for Palatinose™ provides **sustained energy for cognitive functioning**
- In school children, Palatinose™ improved cognitive performance in the **late morning**, with
  - ⇒ **better memory**
  - ⇒ **improved mood**

Children seem particularly susceptible to the benefits of Palatinose™



Young H, Benton D (2015) Eur J Nutr 54(4):1013-20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4540784/pdf/394_2014_Article_779.pdf

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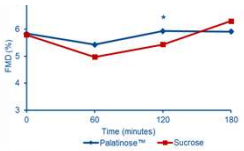
Vascular Health

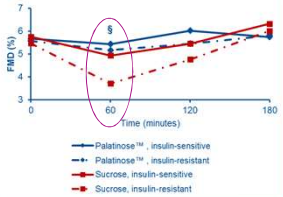
PALATINOSE™ PRESERVES BLOOD VESSEL RELAXATION AFTER A MEAL

Blood vessel relaxation; all subjects



- 2 hours after Palatinose™ intake, blood vessel relaxation was significantly better, i.e. higher compared to sucrose (* p<0.05)
- Overall the decline in blood vessel relaxation due to a meal was attenuated with Palatinose™- the blood vessels remained more elastic with Palatinose™

Blood vessel relaxation; insulin sensitive vs insulin resistant adults



- Negative effect of sucrose is particularly strong in adults with insulin resistance (§ p=0.1)
- In this group, also the difference between Palatinose™ and sucrose is more pronounced

Groot, de, Eric, Schweitzer L, Theis S (2020) Nutrients 12(1):141. https://www.mdpi.com/2072-6643/12/1/141

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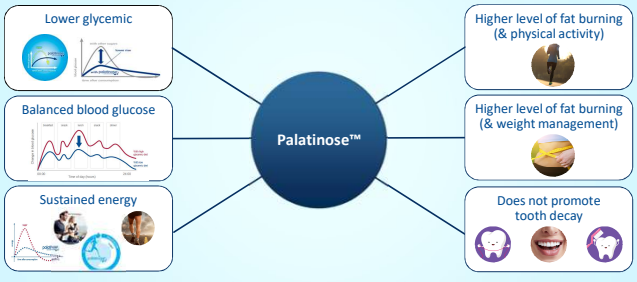
PALATINOSE™ – WHICH CLAIMS CAN BE MADE ON PACK?



This slide does not show the exact claims wordings as required by US Regulations. More details available upon request.

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HELPING CONSUMERS UNDERSTAND SUGARS AND CARBS ON THE LABEL

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EXPLAINING ADDED SUGARS ON THE LABEL

cereal

Nutrition Facts
About 8 servings per container
Serving size 1 cup cereal (40g)

	Per 1 cup cereal (40g)	Per cup cereal (40g) with milk
Calories	160	200
		%DV*
Total Fat	0g	0% 0g 0%
Saturated Fat	0g	0% 0g 0%
Trans Fat	0g	0g
Cholesterol	0mg	0% 10mg 0%
Sodium	170mg	7% 220mg 10%
Total Carb.	37g	13% 41g 15%
Dietary Fiber	1g	3% 1g 3%
Total Sugars	4g	10g
Incl. Added Sugars	3g	7% 3g 7%
Protein	3g	7g
Vitamin D	0mcg	0% 2mcg 8%
Calcium	0mg	0% 349mg 25%
Iron	0.45mg	2% 0.49mg 2%
Potassium	94mg	2% 285mg 6%

soda

Nutrition Facts
1 serving per container
Serving Size 8.4 fl oz (248 mL)

Amount Per Serving	
Calories	90
	% Daily Value
Total Fat 0g	0%
Sodium 15mg	1%
Total Carbohydrate 21g	8%
Total Sugars 19g	
Includes 0g Added Sugars	0%
Protein 0g	

Lightly sweetened with organic fruit juice for those who like to avoid sugar.

INGREDIENTS:
Corn meal* and/or yellow corn flour*, grape* and/or pear* juice concentrate, sea salt. *Organic.

SPARKLING WATER, APPLE JUICE CONCENTRATE, WHITE GRAPE JUICE CONCENTRATE, CLARIFIED ORANGE JUICE CONCENTRATE, CITRIC ACID, NATURAL FLAVOR, CLARIFIED CLEMENTINE JUICE CONCENTRATE, GUM ARABIC, ACEROLA JUICE CONCENTRATE, BETA CAROTENE (COLOR), ASCORBIC ACID (VITAMIN C), NIACINAMIDE, PYRIDOXINE HYDROCHLORIDE (VITAMIN B6)

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EXPLAINING FIBER AND CARBS ON THE LABEL

Nutrition Facts
Serving size 1 bar (40g)
Calories per serving 180

Amount/Serving	% Daily Value
Total Fat 15g	**19%**
Sat. Fat 3g	**15%**
Trans Fat 0g	
Polyunsaturated Fat 3.5g	
Monounsaturated Fat 7g	
Cholesterol 0mg	**0%**
Sodium 140mg	**6%**
Vitamin D 0% • Calcium 4% • Iron 6% • Potassium 4%	

Amount/Serving	% Daily Value
Total Carb. 16g	**6%**
Fiber 7g	**25%**
Total Sugars 5g	
Incl. 4g of Added Sugars	**8%**
Sugar Alcohol 0g	
Protein 6g	

INGREDIENTS: Almonds, peanuts, chicory root fiber, honey, palm kernel oil, sugar, glucose syrup, rice flour, unsweetened chocolate, alkalized cocoa, sea salt, soy lecithin, natural flavor, cocoa butter.
Allergen Information: Contains almonds, peanuts and soy.
May contain tree nuts and sesame seeds.
May contain nut shell fragments.

Calculated calories: 15 g fat x 9 kcal/g + 9 g carb x 4 kcal/g + 7 g fiber x 2 kcal/g + 6 g protein x 4 kcal/g = 209 calories

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EXPLAINING PALATINOSE™ ON THE LABEL

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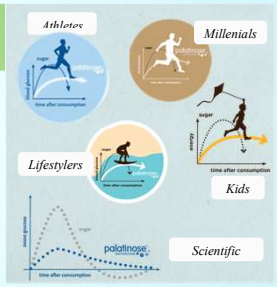
COMMUNICATION, EDUCATION ARE KEY

"The Palatinose™ **chart** does a **good job at explaining the concept**. **Communication** and **education** are **key** to the future success of the ingredient. The chart can help in this effort since **people quickly and visually grasp the message**." (Consumer Research LATAM, 2017)



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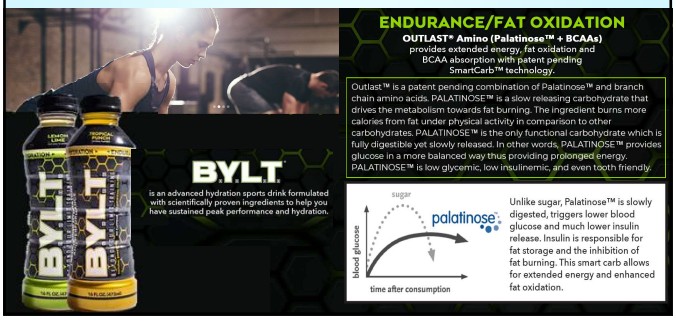
ELITE BEVERAGE INT., B.Y.L.T. SPORTS DRINK WITH PALATINOSE™ | US 2018



ENDURANCE/FAT OXIDATION

OUTLAST® Amino (Palatinose™ + BCAAs) provides extended energy, fat oxidation and BCAA absorption with patent pending SmartCarb™ technology.

Outlast™ is a patent pending combination of Palatinose™ and branch chain amino acids. PALATINOSE™ is a slow releasing carbohydrate that drives the metabolism towards fat burning. The ingredient burns more calories from fat under physical activity in comparison to other carbohydrates. PALATINOSE™ is the only functional carbohydrate which is fully digestible yet slowly released. In other words, PALATINOSE™ provides glucose in a more balanced way thus providing prolonged energy. PALATINOSE™ is low glycemic, low insulinemic, and even tooth friendly.

Unlike sugar, Palatinose™ is slowly digested, triggers lower blood glucose and much lower insulin release. Insulin is responsible for fat storage and the inhibition of fat burning. This smart carb allows for extended energy and enhanced fat oxidation.

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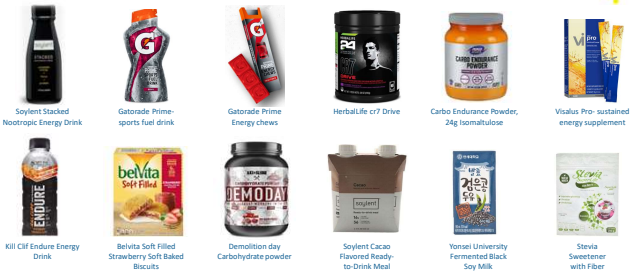
MARKET PRODUCTS WITH ISOMALTULOSE



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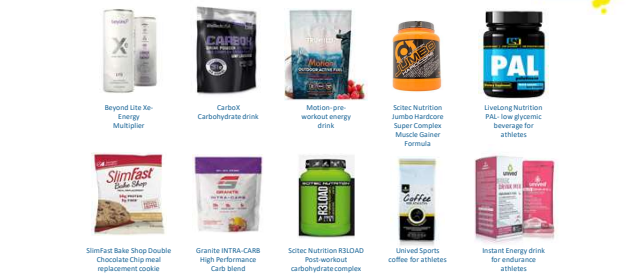
MARKET PRODUCTS WITH ISOMALTULOSE



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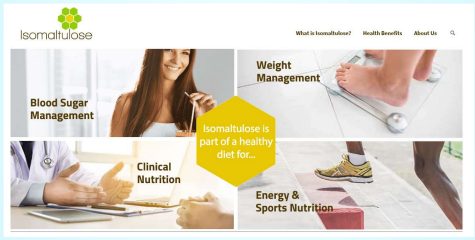
DEDICATED ISOMALTULOSE WEBSITE DEVELOPED BY BENEO FOR HEALTHCARE PROFESSIONALS AND INTERESTED CONSUMERS



https://isomaltulose.org/ 48

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TAKE HOME MESSAGES

- The world of carbs is expanding, with newer carbs that differ metabolically from their saccharide-similar counterparts
- Palatinose™ (isomaltulose), a disaccharide, has a low impact on glycemic response and a sustained energy delivery because of its slow digestion
- As isomaltulose does not behave like an "added sugar" based on its digestion, absorption and metabolic processing, it would be more appropriately counted toward total carbohydrates rather than total or added sugars
- Newer carbohydrates call for an expanded conversation with consumers to help them understand the nuances of sugars and carbs on the label

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THANK YOU!

Mindy Hermann
Hermann Communications
mindy@hermanncomm.com

Denisse Colindres
BENEO-Institute
denisse.colindres@beneo.com

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