Key references related to the physiological benefits of Palatinose™

Palatinose™ – a carbohydrate with unique physiological properties

Palatinose™ (generic name: isomaltulose) is a disaccharide carbohydrate that occurs naturally in honey and sugar cane juice. It is derived from sucrose by enzymatic conversion. And it is a "slow release carbohydrate" with a unique combination of physiological properties: As result of its slow yet complete digestion and absorption, Palatinose™ has a low effect on blood glucose levels (GI: 32) and insulin release. It provides carbohydrate energy in a more balanced way over a longer period of time. And thus it contributes to modern energy management with characteristics like steadier energy supply and a higher contribution of fat oxidation. Apart from that, Palatinose™ is kind to teeth. The slow release properties, the higher fat oxidation and tooth-friendliness are all unique to Palatinose™ and make it different from sugars like fructose or sucrose and HFCS or from malto-oligosaccharides. BENEVO has undertaken comprehensive research to study the unique nutritional and physiological properties of this functional carbohydrate. This document provides a list of the most relevant publications per physiological aspect, while it – by far – does not represent a complete list of references. More detailed information can be provided upon request.

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1. Palatinose™ - a fully available carbohydrate for slow and sustained energy release

   a) Palatinose™ is a fully available carbohydrate

   The essentially complete digestion and absorption of Palatinose™ within the small intestine has been confirmed in human and animal studies. Palatinose™ is a fully digestible carbohydrate and as such provides the full carbohydrate energy (4 kcal/g), respectively.

   Key reference:


   b) Palatinose™ is a slow and sustained release carbohydrate

   The “slow release” aspect is evidenced by enzyme kinetic studies (animal and human enzymes) which show that the enzymatic hydrolysis of Palatinose™ in the small intestine occurs much slower than that of e.g. sucrose (i.e. difference in $V_{max}$ by a factor of 4 to 5). Observations on incretin hormones illustrate that the digestion of Palatinose™ and subsequent absorption is a slow process that is extended to more distal parts of the small intestine. Relevant for the enzymatic hydrolysis in the small intestine is the 2-center-enzyme complex “ucrase-Isomaltase”, responsible for the breakdown of starch-type (respective their break down product isomaltose with an α-1-6 linkage) and disaccharide-type carbohydrates with α-1,2 linkages. Isomaltulose is hydrolysed as the starch-center of the enzyme complex with a slower rate of hydrolysis.

   Enzyme kinetic references:


Incretin response references:


c) Palatinose™ - the carbohydrate for sustained energy supply

The sustained energy supply of Palatinose™ is a result of its slow yet complete digestion and absorption along the small intestine. It is additionally reflected in subsequent metabolic processes: In comparison with readily available carbohydrates, Palatinose™ shows a slower, overall lower and sustained rise in blood glucose levels. Since blood glucose means fuel for the body and its energy metabolism, the sustained glucose supply from Palatinose™ is associated with a more steady and sustained energy gain from carbohydrate oxidation: Palatinose™ provides sustained energy.
Numerous blood glucose response studies have been conducted on behalf of BENEO and specifically analyzed to test whether the characteristics of sustained glucose supply from Palatinose™ can be shown in this methodology with its high variance. The sustained glucose supply of Palatinose™ has been concomitantly shown in all of these studies. Moreover, individual studies confirm the link between sustained glucose supply and sustained carbohydrate oxidation.

2. Palatinose™ - a low glycemic carbohydrate

As result of its slow (yet complete) intestinal release, Palatinose™ has a low effect on blood glucose levels and insulin release. A Glycemic Index (GI) of 32 has been determined for Palatinose™ by Sydney University. The “low glycemic” properties of Palatinose™ have been experimentally verified in extensive research initiated by BENEO - including more than 30 human trials from the past 10 to 15 years conducted according to internationally recognized standard methodology in leading test centers worldwide (see Figure on the right) - and are well described in literature. A corresponding claim has been laid down in EU legislation following the publication of a positive EFSA opinion.

Low glycaemic properties confirmed in over 30 human trials with Palatinose™

Consistent findings with Palatinose™
- LOWER blood glucose response
- LOWER insulin response

Confirmation in a study population of in total >250 adults, and also children, covering healthy people with normal body weight or overweight/obese, with normal or impaired glucose tolerance (including type 1 and type 2 diabetes mellitus).
References of published blood glucose response studies:


3. Palatinose™ and long-term blood glucose control and insulin sensitivity

Longer-term studies investigated the effects of Palatinose™ on blood glucose control and insulin sensitivity. Some examples are listed here.

References:


4. Palatinose™ and its role in weight management

As result of its slow release properties and resulting lower and sustained blood glucose response, Palatinose™ triggers less insulin release and therefore enables higher fat oxidation in energy metabolism. Higher levels of fat burning with Palatinose™ in comparison with conventional carbohydrates such as e.g. sucrose or maltodextrin (but also in comparison with fructose) have been observed in human intervention studies with healthy and overweight individuals at mostly sedentary conditions (see below) as well as with physically active trained persons (see 5.). Related long-term benefits of Palatinose™ refer to body weight and body composition: Longer-term feeding studies in animals reported beneficial effects of Palatinose™ on body fat accumulation and body weight. Some publications provide first human data on the effect of Palatinose™ on body composition, i.e. visceral fat accumulation.

a) Palatinose™ and its influence on fat oxidation in energy metabolism


Review:

b) Long-term benefits of Palatinose™ on body weight and body composition


5. Palatinose™ in sports nutrition

Palatinose™ provides the desired carbohydrate energy for physical activity in a more steady way and at the same time promotes a higher contribution of fat oxidation in energy metabolism than commonly used readily available carbohydrates. A higher level of fat burning is of particular interest in endurance activity where it may spare carbohydrate sources (glycogen) for enhanced endurance. The effect of Palatinose™ on substrate utilization and fat oxidation has been shown in a series of intervention studies.

References:


Review:

Research at Swansea University investigated the benefits of Palatinose™ on fat oxidation, metabolic control and incidences of hypoglycemia during physical activity in men with type 1 diabetes mellitus, which has been published in a series of studies including the following ones:


6. **Palatinose™ and its potential in cognitive performance and mood**

Carbohydrates and their supply of glucose to the brain play a central role in cognitive performance and mood. Palatinose™ with its steady and sustained glucose supply is of particular interest with respect to beneficial effects in the later phase after a meal. The potential of Palatinose™ in cognitive performance and mood has been addressed in the following key studies:


7. Palatinose™ is kind to teeth

Palatinose™ is no substrate for oral bacteria and therefore the first sugar that is kind to teeth. Its tooth-friendliness has been confirmed in pH telemetry studies. A corresponding claim has been accepted a) in the USA by FDA and implemented in the Code of Federal Regulations as well as b) in the EU following the publication of a positive EFSA opinion.

References:


8. Palatinose™ in infant and small children nutrition

Palatinose™ is suitable for infants from the age of about 4-6 months, when complementary feeding starts. It provides benefits to milk formula applications when used in place of maltodextrin, glucose or other high glycemic carbohydrates, as it is slowly and fully available and therefore delivers the necessary energy for the infants and small children in a more balanced way. Hence, Palatinose™ brings the metabolic profile closer to that of mother milk. The suitability and good tolerance of Palatinose™ have both been confirmed in a study with infants.
Reference:


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