

More than just carbs

Prebiotics and functional carbohydrates possess health effects beyond basic energy supply.



**Nutri
Scene**

DR TEE E SIONG

starhealth@thestar.com.my

CARBOHYDRATES are the single most important source of food energy in the world. The main sources of carbohydrates in the diet are starches in cereals and grains.

The understanding of the role that carbohydrates play in human nutrition and health has made great strides in the past decades.

Not only are carbohydrates a main source of energy, but this macronutrient also plays important roles in maintaining health.

A symposium held in Singapore in December 2007 discussed the role of functional carbohydrates in physiology and health. Functional carbohydrates were defined as exerting health effects beyond basic energy supply. I was invited to co-chair this symposium and I would like to share with you the highlights from the discussion.

Symposium on functional carbohydrates

Over 250 nutritionists, dietitians, health practitioners, food scientists, researchers and regulators working in the food and nutrition area in the Asian region attended this symposium on prebiotics and functional carbohydrates, and their interaction with physiology and health.

There were three sessions in the symposium. Session 1 focused on the functional carbohydrates isomalt and isomaltulose. In session 2, the science surrounding inulin and oligofructose as prebiotics was discussed. In the final session, two speakers discussed outlooks for functional carbohydrates.

Isomal and isomaltulose as functional carbohydrates

Four scientists spoke on different aspects of isomalt and isomaltulose.

Dr Gunhild Kozianowski, vice president, Nutrition Science of BENEIO Group, introduced to the audience these two functional carbohydrates. Aspects covered include their production, chemistry, digestion and physiological properties.

Isomaltulose is a functional disaccharide resulting from the enzymatic rearrangement of sucrose. The altered bond of fructose and sucrose renders isomaltulose slowly, but completely digestible in the upper gastrointestinal tract. It thus elicits a low glycaemic and insulin response and concomitantly sustains a longer blood glucose supply.

Isomalt is a polyol, obtained by hydrogenation of isomaltulose. It is only partially digested in the small intestine; large portions enter the colon where they are fermented by the lower gut flora similar to fibres.

The most prominent functional property of isomalt is its resistance towards fermentation by the oral flora. It is said to be tooth-friendly, having passed the pH telemetry test.

This topic of non-fermentable sugars and dental caries prevention was further dealt with in detail by Dr Lutz Stoesser of the Department of Preventive Dentistry, University of Jena, Germany.

He reviewed present knowledge on non-fermentable sugar replacers and their interaction with dental plaque, dental hard tissue and saliva. The sugar replacers isomalt, xylitol, maltitol and sorbitol, which are most commonly used in confectionery today, can largely take over the role of sugar in food from a food technological point of view, either on their own or combined.

They are well-tolerated by the human metabolism and in relation to dental caries, these sugar replacers are hypoacidogenic or non-acidogenic, since they are either not con-



Considerable differences in permitted nutrition and health claims in countries exist in the South-East Asian region. - AFP photo

verted by bacteria or are converted after a delay, with a different pattern of acids.

The role of low glycaemic diet on health was reviewed by Dr Geoffrey Livesey of Independent Nutrition Logic, UK. He presented scientific findings to show that a new era in obesity, diabetes and cardiovascular health research has arisen with focus on dysglycaemia and low glycaemic carbohydrates.

Diabetes and heart disease, prevalent in the obese, are lowest in populations with a low glycaemic load (due to low-glycaemic index carbohydrates) and higher unavailable carbohydrate intake.

Dr Daniel Koenig, Division of Prevention, Rehabilitation and Sports Medicine, University of Freiburg, Germany, provided an overview of the role of carbohydrates in fat oxidation and sports nutrition.

In recent years, the role of carbohydrate in sports nutrition has been studied with a focus on the glycaemic index (GI) of carbohydrates ingested.

In contrast to foods with a low GI, meals with a high GI are associated with increased post-prandial insulin levels (i.e. insulin levels after a meal) leading to decreased fat oxidation, which is often undesirable during extensive exercise.

Dr Koenig presented findings from studies, including using a drink containing isomaltulose, to show that a low GI is associated with a shift towards fat oxidation and this increased fat oxidation may lead to glycogen sparing and improved performance.

However, he acknowledged that more controlled studies are needed, particularly with long-term follow-up designs in order to clarify the role of specific sugars such as isomaltulose with respect to increased performance or weight control and improvement of metabolic risk factors.

Inulin and oligofructose as prebiotics

In session 2 of the symposium, four presentations dealt with various aspects of the physiological and health effects of prebiotic fibres, inulin and oligofructose.

Marcel Roberfroid, Professor Emeritus of Catholic University of Louvain, Belgium, provided an overview of the role of these prebiotic fibres in human health.

Inulin-type fructans (ITFs) is a generic term to cover all $\beta(2,1)$ linear fructans including chicory inulin, its partial hydrolysis product oligofructose, long-chain inulin, as well as a specific product known as oligofructose-enriched inulin.

ITFs resist hydrolysis by intestinal digestive enzymes and are classified as dietary fibres. In the colon, they are rapidly and selectively fermented by bifidobacteria (and possibly a few other genera) that are, consequently, preferentially stimulated to grow, thus causing significant changes in the composition of the gut microflora by increasing the number of

potentially health promoting bacteria and reducing the number of potentially harmful species.

ITFs are therefore prebiotic. He highlighted that ITFs can bring about a number of physiological and health benefits including immune functions, enhance calcium and magnesium absorption, normalisation of blood triglycerides, and possibly reduce the risk of inflammatory bowel diseases and colon carcinogenesis.

The role of prebiotics in the modulation of immune response and inflammation was further elaborated by Dr Francisco Guarner, Digestive System Research Unit, University Hospital Vall d'Hebron, Spain.

Prebiotics such as inulin and oligofructose improve the composition and biochemical activities of the microbial communities within the gut. Numerous studies have shown that both inulin and oligofructose selectively stimulate the growth of bifidobacteria and lactobacilli both in the gut lumen and in mucosa-associated microbial communities. These changes have an important impact on immune homeostasis.

Studies with infants and different animal models suggest that supplementation with these prebiotics positively affects the postnatal immune development and increases the production of secretory IgA. These mechanistic studies suggest a role of inulin and oligofructose in the prevention of a number of immuno-inflammatory disorders.

Dr Genevieve Veereman, Division of Pediatric Gastroenterology, Hepatology and Nutrition, Queen Paola Children's Hospital, Belgium, presented evidence on the benefits of inulin and oligofructose from birth till adolescence.

A mixture of long chain inulin in combination with galacto-oligosaccharides (GOS) has been added to infant formula in Europe in a 10%-90% ratio for over five years. Clinical studies have demonstrated that these prebiotic formulas have significant effects on flora composition and metabolism, improve stool consistency, and reduce the incidence of gastrointestinal and respiratory infections.

Dr Veereman also reported that oligofructose in weaning foods consumed by toddlers increases faecal bifidobacteria counts and decreases faecal clostridia during consumption, leading to softer stools, fewer fever episodes and other gastro-intestinal symptoms.

In adolescents short and long-term calcium absorption is strongly improved by daily intake of oligofructose-enriched inulin in calcium fortified orange juice or milk. After a year of supplementation, whole body bone mineral content and density are significantly increased in the supplemented group.

The role of prebiotics in the management of appetite, obesity, and metabolic syndrome was reviewed by Nathalie Delzenne, Unit of Pharmacokinetics, Metabolism, Nutrition and

Toxicology, Catholic University of Louvain, Belgium.

Supplementation of the diet with inulin-type fructans has been shown to favourably modulate lipid and glucose metabolism in several animal models. Oligofructose was found to decrease food intake, fat mass development, and hepatic steatosis when added in the diet of normal and obese rats.

These results fit with the idea that specific modulations of colonic bacteria in the colon by prebiotic fructans can play a role on the development of metabolic diseases associated to obesity.

Outlook for functional carbohydrates

In this last session, two presentations were made. I provided an overview of the current regulations on communicating health messages on products, specifically nutrition and health claims.

Considerable differences in permitted nutrition and health claims in countries exist in the South-East Asian region. Most of these countries allow nutrient content and comparative claims.

The criteria used for these claims generally follow the guidelines of Codex, but differences exist. Major differences exist amongst the countries in the nutrient function claims that are permitted.

Disease risk reduction claims are prohibited in most countries in the region. Countries have rather different systems in place for regulating nutrition labelling and claims. There has definitely been increased interest among regulatory agencies in the region to better regulate nutrition claims and are in the process of reviewing these.

In the last presentation of the symposium, Dr Friedrich Gustav Markwart Kunz, member of the Executive Board of Suedzucker AG, Germany, looked into the future of functional carbohydrates. He highlighted that challenges for the future are the optimisation and further scientific substantiation of health-related properties of existing products as well as the development of ingredients with additional health benefits.

An example for a new concept would be optimised gut fermentation with substances that reach the more distal parts of the colon and yield high butyrate levels for optimal gut health.

Another challenge is to find ingredients and nutritional concepts to further combat obesity using new and supplementary mechanisms to what is available today.

He emphasised that implementation of any nutritional concept into practice and obtaining the acceptance by the consumers require the combined efforts of academia, industry and regulators.

Prebiotics are already very much in the local scene. There is already regulatory approval for use of inulin and oligofructose and other inulin-type fructans.

A bifidogenic claim has also been approved. I am sure we will be hearing more of the functional potential of specific carbohydrates, beyond their basic nutritive role.

■ *NutriScene is a fortnightly column by Dr Tee E Siong, who pens his thoughts as a nutritionist with over 30 years of experience in the research and public health arena. For further information, e-mail starhealth@thestar.com.my. The information provided is for educational and communication purposes only and it should not be construed as personal medical advice. Information published in this article is not intended to replace, supplant or augment a consultation with a health professional regarding the reader's own medical care. The Star does not give any warranty on accuracy, completeness, functionality, usefulness or other assurances as to the content appearing in this column. The Star disclaims all responsibility for any losses, damage to property or personal injury suffered directly or indirectly from reliance on such information.*