To the Scientific Advisory Committee on Nutrition (SACN), Public Health England

Tate & Lyle and DuPont Danisco welcome the Draft Carbohydrates and Health report, and the opportunity to submit comments on the scientific aspects or questions for clarification purposes, in relation to polydextrose.

1. Listing of polydextrose

In the SACN draft report, polydextrose is listed under Chapter 6 (page 82): 'Sugars, sugar alcohols, sugars-sweetened foods and beverages'. This classification is incorrect[1]. Polydextrose is a randomly linked complex glucose polymer that contributes 1 kcal/g[2] of energy and is widely used as a sugar replacer, bulking agent, and dietary fibre. Polydextrose itself has limited sweetness and is often used in conjunction with intense sweeteners.

1.1 Structure of polydextrose

The structure of polydextrose is determined by its production process. The United Nations Food and Agriculture Organization (FAO) and World Health Organization (WHO) Joint expert Committee on Food Additives (JECFA) defines polydextrose(s) as: *Randomly bonded condensation polymers of glucose with some sorbitol end-groups, and with citric acid or phosphoric acid residues attached to the polymers by mono or diester bonds. They are obtained by melting and condensation of the ingredients which consist of approximately 90 parts D-glucose, 10 parts sorbitol and up to 1 part citric acid or 0.1 part phosphoric acid. The 1,6-glucosidic linkage predominates in the polymers but other linkages are present*' [3]

Polydextrose is manufactured and marketed in accordance with the Food Chemical Codex (FCC) Specification.[4]

More detailed structural analyses have determined that the average degree of polymerisation of polydextrose is approximately 12 monosaccharide units (weight average molecular weight of ~2,000 Daltons, with a range of 162 to ~20,000). Approximately 40% of polydextrose monomeric units are unbranched, 20% have a single branch, 5% a double branch and 2% a triple branch. Approximately 30% are terminal units. 6-linked monomeric units predominate at about 40% with 4, 3 and 2 linkages at around 20% each[5,6].

Polydextrose resists digestion in the upper gastrointestinal tract of humans, eliciting a negligible glycaemic and insulinaemic response. It is then partially fermented by the colonic microflora, generating short-chain fatty acids. Approximately 50% of the monomeric equivalents of polydextrose are excreted intact.[5]

1.2 Legal status of polydextrose in Europe

Polydextrose is an approved additive in Europe, listed as E1200, polydextrose under the heading 'Additives other than colours and sweeteners' in the Commission Regulation (EU) No 1129/2011[7], permitted for general use to quantum satis. In addition, PDX is listed in the Novel Food Catalogue as a food ingredient, i.e. it can be marketed as a fibre ingredient without additional Novel Food approval. It is clear that polydextrose does not comply with the definition of 'sugars' as defined in Council Directive 2001/111/EC[8]. Here 11 varieties of sugars are listed, all of which are either mono- or disaccharides. The draft SACN Carbohydrates and Health Report[1] also refers to 'sugars' as 'mono- and di-saccharides (Section 2.4, Page 11). Sugar alcohols are listed in Commission Regulation (EU) No 1129/2011 under the category 'Sweeteners'.

Polydextrose conforms to the definition of 'fibre' as included in Commission Directive 2008/100/EC[9] (and subsequently Annex 1 Regulation (EU) 1169/2011). This states that ' "fibre" means carbohydrate polymers with three or more monomeric units, which are neither digested nor absorbed in the human small intestine and belong to the following categories: edible carbohydrate polymers naturally occurring in the food as consumed; edible carbohydrate polymers which have been obtained from food raw material by physical, enzymatic or chemical means and which have a beneficial physiological effect demonstrated by generally accepted scientific evidence; edible synthetic carbohydrate polymers which have a beneficial physiological effect demonstrated by generally accepted scientific evidence.' Polydextrose has been formally endorsed as a fibre in over 30 countries around the world, based on evidence of its physiological benefits, the most recent of which was that by Health Canada.[10] Polydextrose is widely accepted as a fibre in Europe and formal approvals have been provided by many authorities including those in Finland, France, Belgium, Norway, Austria, UK and Italy, and the UK provided clarity on its labelling as a dietary fibre ingredient in 2010.

1.3 Conclusion

The inclusion of polydextrose under Chapter 6 in the SACN draft report is incorrect and risks misleading readers over the nature of this randomly linked complex glucose polymer. Moreover given that polydextrose is essentially not sweet[5], it is clear that the categorization as 'Sugars, sugar alcohols, sugar sweetened beverages' is wholly inappropriate. ,The Correct inclusion would be under Chapter 8, dietary fibre; or at the very least it should be added to Chapter 9: 'Non-digestible oligosaccharides, resistant starch and polydextrose'.

Equally, in the supporting document Colo-rectal health within the chapter Non-digestible carbohydrate and colo-rectal function, polydextrose is reviewed together with the polyols, which is incorrect.

2. Health benefits of polydextrose

2.1 Colo-rectal health

For polydextrose, under the heading "colo-rectal health", reference is made in relation to faecal bacterial content, including 4 studies (Jie et al., 2000; Hengst et al., 2008; Boler et al., 2011; Costabile et al., 2012).

We would like to point out that the correct reference to the first author of the third publication should be Vester-Boler et al., 2011.

It was concluded that no effect exists between polydextrose and faecal bacterial content, based upon moderate evidence. Several other studies on polydextrose and the effect on faecal microbiota have been published, which are not included in the SACN draft report.

It is not clear if increased faecal bacterial content in general, or selective increased faecal bacterial content, is regarded as a beneficial effect, indicating increased colonic fermentation. In the SACN draft report, it is stated that whether the effect on faecal bacteria is beneficial and of biological relevance is currently unclear. In the document on the Systematic review of evidence: carbohydrate and colo-rectal health, faecal bacteria is included as a colorectal health endpoint for a normal colorectal function. It is further not clear why, if faecal microbiota are not regarded as something (potentially) beneficial, why the evaluation and inclusion thereof in relation to several fibre-type ingredients is relevant to the SACN draft report on carbohydrates and health. Similar comments can be made for faecal pH and short chain fatty acid content. In this regard, it has to be mentioned that faecal pH and SCFA content are not necessarily representative for a colonic condition, as clearly recognized by Health Canada which gave a positive opinion on polydextrose as a dietary fibre. In this case, in-vitro and animal data could provide useful information to support increased saccharolytic colonic fermentation.

2.2 Faecal bulking/output

In the main SACN draft report, there is no entry for polydextrose on faecal bulking. In the supporting document “Systematic review of evidence: carbohydrate and colo-rectal health”, several publications are referenced in relation to polydextrose and faecal bulking (Tomlin & Read, 1988a; Achour et al., 1994) or faecal output (Jie et al., 2000; Hengst et al., 2008).

The SACN Systematic review of evidence: carbohydrate and colo-rectal health indeed states that Tomlin & Read (1988) and Achour et al. (1994) suggest a faecal bulking effect of polydextrose. In addition, 3 published studies have not been included in this review in relation to faecal bulking. Endo et al. (1991) reported a significant increase in faecal weight with 15 g/day of polydextrose, Vester-Boler et al. (2011) reported a significant increase in faecal (dry) bulk with 21 g/day of polydextrose, and Timm et al., (2013) reported a significant increase in faecal weight with 20 g/day of polydextrose. Hengst et al. (2008) did not report statistically significant changes in stool weight, potentially due to the very high variation in stool weights in both the test and placebo groups, and the relatively low dose. Jie (Zong) et al. (2000) did report a significant increase with similar doses of 8 and 12 g/day of polydextrose. Achour et al. (1994) reported a non-significant increase in faecal weight between 30 and 34% with 30 g/day of polydextrose, and Tomlin & Read (1988) reported a significant increase of stool weight with 30 g/day of polydextrose.

We seek clarification why an evaluation of polydextrose in relation to increased faecal bulking has not been included in the SACN draft report.

References

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5. Stowell, J D (2009) Polydextrose, in Fiber Ingredients Food Applications and Health Benefits Ed Cho, S S and Samuel P CRC Press ISBN 978-1-4200-4384-6
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7. Commission Regulation (EU) No 1129/2011 of 11 November 2011, amending Annex II to Regulation (EC) No 1333/2008 of the European Parliament and of trhe Council by establishing a Union list of food additives.
8. Council Directive 2001/111/EC of 20 December 2001 relating to certain sugars intended for human consumption
9. Commission Directive 2008/100/EC of 28 October 2008, amending Council Directive 90/496/EEC on nutrition labelling for foodstuffs as regards recommended daily allowances, energy conversion factors and definitions
10. http://www.foodnavigator-usa.com/Regulation/Health-Canada-permits-fiber-labeling-of-polydextrose