Table 4.5 Calorific value of sugar substitutes (kcal/g).

Sugar substitute	Europe	USA
Isomaltulose	4.0	4.0
Maltitol	2.4	2.1
Lactitol	2.4	2.0
Isomalt	2.4	2.0
Sorbitol	2.4	2.6
Xylitol	2.4	2.4
Tagatose	[1]	1.5
Erythritol	0.0	0.2
Polydextrose	1.0	1.0
Inulin	1.0	[1]

[1] No current legislation.

Table 4.6 Glycaemic response and suitability of sugar substitutes for tooth-friendly chocolate.

Sugar substitute	Substance group	Glycaemic response versus glucose = 100[1]	Suitable for tooth-friendly chocolate
Sorbitol	Sugar alcohol	<5	+
Mannitol	Sugar alcohol	<5	+
Isomalt	Sugar alcohol	4.7	+
Maltitol	Sugar alcohol	34	+
Lactitol	Sugar alcohol	2	+
Xylitol	Sugar alcohol	8	++
Erythritol	Sugar alcohol	0	+
Fructose	Saccharide	19	—
Tagatose	Saccharide	3	+
Isomaltulose	Saccharide	32	+
PDX Litesse®II	Polysaccharide	7	+
PDX Litesse®Ultra	Polysaccharide	4	+
Inulin	Polysaccharide	4	—

[1] Foster-Powell *et al.* (2002), Sydney University Glycaemic Research Service, personal communication, Cerestar (2004), Beneo-Group (2010).

carbon atoms per molecule. Molecular size is a poor indicator of physiological properties. The glycaemic response depends strongly upon the rate and efficiency of digestion by microbiological fermentation in the colon and its absorption and metabolism (Mitchell, 2002).

Even sucrose sweetened chocolates do not have a high glycaemic index. But using suitable sugar replacers can significantly reduce it even further. This is demonstrated in Table 4.7 for milk chocolates made using the recipe given in Table 4.8.

Table 4.7 Glycaemic response of milk chocolate made with 45% sucrose or sweeteners (Sydney University Glycaemic Research Service, personal communication).

Sweetener	Response
Sucrose	37
Maltitol	19
Lactitol/polydextrose	6

Table 4.8 Milk chocolate made with sucrose and sweeteners.

Sweetener	%
Cocoa liquor	11.00
Cocoa butter	22.00
Full cream milk powder	20.00
Skimmed milk powder	1.48
Sugar/Sweetener[1]	45.00
Lecithin	0.50
Vanillin	0.02

[1] 1. 45% sucrose, 2. 45% maltitol, 3. 33.00% anhydrous lactitol with 11.85% polydextrose, 0.13% aspartame, 0.02% acesulfame K.

4.9 The sweetening power of sugars and bulk sweeteners

In the sensory evaluation of the sweetening power, sucrose generally serves as a standard to which the sweetness of the other bulk sweeteners is compared. "Sweetening power" and "degree of sweetness" are the terms employed. The sweetening power is the intensity of sweetness expressed as a percentage in comparison with sucrose, which is assumed to be 100%. The degree of sweetness expresses the intensity of the sweet taste as a fraction of the sucrose's sweetness, which is equal to 1.00. Table 4.9 lists the degrees of sweetness of important sugars and sugar alcohols (Hyvönen *et al.*,1977; Carpenter, 1984; Krüger *et al.*, 1996; Franck, 2002).

As can be seen from Table 4.9 fructose is sweeter than sucrose and the sugar alcohol xylitol is as sweet as sucrose. This table is representative of many publications. However, it only provides guideline values for the confectioner, because many comparisons were apparently based on aqueous solutions of pure sugars and, more often than not, statements regarding the solids content of the sampled solutions are missing. It is, moreover, important to remember that the sweetening power of various sweeteners does not increase linearly with concentration and is dependent on temperature and other raw material ingredients in the foodstuffs, as well as the pH value.