presence of milk fat. Although CBS fat does not need to be tempered it does display some polymorphism: rapid cooling ensures rapid formation of the stable fat crystals and removes the latent heat of fusion. Sorbitan tristearate is often used in the manufacture of CBS containing chocolate compounds and, although it is listed as an emulsifier in ingredient lists, it functions primarily as an anti-bloom agent. Ideal storage conditions of chocolate compounds after manufacture are different to those of chocolate products. Whereas chocolate products should ideally be kept below 18 °C to prevent bloom occurring, chocolate compounds manufactured using CBS should be stored between 20 and 25 °C (Talbot and Smith, 2005) to best prevent the formation of bloom. Hence compounds and coatings often perform better than chocolate in warm climates.

19.5.4 Texture and prevention of cracking

Using chocolate compounds in place of chocolate gives the manufacturer much more flexibility in terms of the texture and can overcome many of the issues experienced when using chocolate. Examples would be in cake decoration: where a chocolate may crack and break away from the cake, a softer compound chocolate would not do so. This requires the selection of a suitable CBR or perhaps the use of some coconut oil in conjunction with CBS to give a softer texture. With chocolate the only option is the use of anhydrous milk fat to modify texture. It is also possible to manufacture ice cream coatings to enrobe an ice cream dessert that can be cut with a knife without cracking the coating after storage in a domestic freezer (–18 °C). This requires the use of lower melting oils such as sunflower oil, rapeseed oil or cottonseed oil in conjunction with coconut oil or palm olein to give the right texture.

19.5.5 Health benefits

The use of compound chocolates also permits the manufacturer to step outside of the rigorous chocolate legislation to produce products with dietary or health benefits. Milk- or lactose-free products can be manufactured using milk substitutes which would otherwise likely leave the manufacturer short of the milk solids required to meet milk chocolate legal requirements. Low-calorie or calorie-reduced products are more readily achieved if using compound chocolates. With fat delivering 37 kJ/g (9 kcal/g) of energy and carbohydrates and proteins both delivering 17 kJ/g (4 kcal/g) of energy, it is clearly desirable to keep the fat content to a minimum when attempting to produce a calorie-reduced product. Being able to use a compound chocolate at higher temperature (40 °C) than chocolate due to tempering not being required allows a much lower fat content to be utilised for a similar usage viscosity. Fat contents between 22 and 24% are easily achieved with the use of emulsifiers (lecithin and polyglycerol polyricinoleate), which would compare in viscosity to a chocolate containing 30% fat when it is used at 30 °C (tempered). If polyols or other sugar replacers are used to reduce or replace the sugar component of the chocolate compound then, in conjunction with the lower fat contents that are achievable, significant reduction

in calories can be achieved. It is possible that the pathway to healthier confectionery will involve a new generation of compounds combining the benefits of cocoa polyphenols with low calories, lower fats and high fibre.

19.6 *Trans* fatty acids in chocolate compounds

Along with the potential health benefits (see above), there are also some health concerns associated with some types of compounds and coatings.The process of manufacture for CBR fat has traditionally involved hydrogenation or partial hydrogenation of a vegetable fat. Partial hydrogenation results in the formation of saturated fats but also results in some level of *trans* fatty acids being present. Note that full hydrogenation does not produce a fat containing *trans* fatty acids. CBS fats are usually manufactured using fractionation but some hydrogenation may be used. Consequently, CBS fats are lower or free from *trans* fatty acids but contain a greater amount of saturated fat. As chocolate is manufactured from a naturally occurring vegetable fat, cocoa butter, it also contains levels of saturated fat, but it does not contain *trans* fatty acids. These *trans* geometric isomers do not occur naturally in vegetable fats, and only occur naturally in some animal fats. Only the *cis* geometric isomers occur naturally in vegetable fats. The partial hydrogenation of a vegetable fat produces both *cis* and *trans* isomers of fatty acids. For example, in producing the *cis* geometric isomer oleic acid the *trans* geometric isomer elaidic acid is also produced. This in the past has been highly desirable for the fat manufacturers as the *trans* geometric isomers pack much more closely together in crystal formation due to the carbon chain being of a much more linear structure and hence they have a higher melting point.

There is now considerable evidence that *trans* fatty acids in the diet contribute to the onset of cardiovascular disease and increase the risk of coronary heart disease. The *trans* fatty acids contribute to the increase of low density lipoproteins (sometimes called bad cholesterol) and the decrease of high-density lipoproteins (sometimes called good cholesterol) in the blood stream. There is a drive, supported by legislation, in many markets to remove or reduce *trans* fatty acids from the diet. Major fat manufacturers have already succeeded in manufacturing CBR fats that are either low in *trans* fatty acids or free of *trans* fatty acids and these are now in widespread use. The alternative for the confectionery manufacturer is to switch to a CBS fat which is fully hydrogenated and hence does not contain *trans* fatty acids or to use a CBE fat (super compound) which then has the disadvantage of requiring tempering.

The health concerns surrounding saturated fatty acids are less clear, with many contradictory claims. Most health and governmental bodies, however, advise that high quantities of saturated fat in the diet can contribute to cardiovascular disease. Again, major fat manufacturers are producing alternatives that have reduced quantities of saturated fat.