

CHAPTER 22

Nutritional and health aspects of chocolate

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22.1 Introduction

Chocolate is a food with worldwide popularity. Having a high sugar and fat content, chocolate is often viewed as an indulgence that should be consumed sparingly or eliminated from the diet entirely. Chocolate and cocoa, however, contain a number of essential minerals and vitamins, as well as non-nutritive bioactive components including polyphenols, methylxanthines, and mono-unsaturated fatty acids. Emerging evidence suggests that chocolate and cocoa have beneficial health effects related to cardiovascular disease, metabolic syndrome, neurodegenerative diseases, and other chronic health conditions. Although the existing results are promising, additional studies, especially randomised clinical trials, are needed, to clearly demonstrate efficacy, identify the relative contributions of individual chocolate components and provide information to consumers which allow rational dietary choices to be made.

According to the National Health and Nutrition Survey (NHANES), 12.9% of adults in the United States in 2004 were chocolate consumers and the mean chocolate consumption was 40 g/day (O'Neil *et al.*, 2011). Although often viewed as an indulgence food, containing high amounts of sugar and fat which should be avoided or consumed sparingly, chocolate contains a number of important vitamins and minerals. There is also growing evidence that cocoa-derived phytochemical constituents in chocolate may mitigate the potential health impacts of the added sugar and fat derived from consuming chocolate (Gu and Lambert, 2013; Sokolov *et al.*, 2013). In addition, evidence suggests that relative to other foodstuffs with similar amounts of fat, the fatty acid composition of cocoa butter has neutral to beneficial effects on cardiovascular disease risk factors. The nutritional composition of a particular chocolate product is dependent on the amount of cocoa solids present and, therefore, discussions on the relative health benefits of chocolate should be more nuanced and focused on particular product formulations (see Chapter 20).

Table 22.1 Typical macronutrient and energy content of the major kinds of solid chocolate^a.

	Nutrient content (per 100 g)			
	Protein (g)	Fat (g)	Carbohydrate (g)	Energy (kcal)
Type of chocolate				
Milk	7.65	29.7	59.4	535
White	5.87	32.1	59.2	539
Dark (45–59%)	4.88	31.3	61.2	546

^a USDA National Nutrient Database for Standard Reference, Release 27.

22.2 Macronutrients

Chocolate contains varying amounts of energy-providing macronutrients depending on the type of chocolate and the amount of cocoa solids present. Table 22.1 shows the amount of fat, protein and carbohydrate, as well as energy present in the major solid chocolate types.

22.2.1 Fats

The fat content in chocolate is principally derived from cocoa butter. Cocoa butter consists primarily of stearic acid (C18:0, 34%), oleic acid (C18:1, 34%), and palmitic acid (C16:0, 27%). Stearic acid has been reported to have minimal effect on serum cholesterol levels, whereas an increasing body of data suggests that oleic acid may improve serum cholesterol levels and other cardiovascular risk factors (Lopez-Huertas, 2010; Sales-Campos *et al.*, 2013). Palmitic acid has been shown to moderately increase serum cholesterol levels. Tropical oils typically used as cocoa butter substitutes (e.g. shea butter) are also rich in stearic acid.

22.2.2 Carbohydrates

Sucrose added during chocolate manufacture is the largest carbohydrate source in the final product. Other carbohydrates, including glucose, dextrins, flours and starches, may be included during the manufacture of confectionery products. In addition, cocoa powder contains a significant amount of fibre (37% by dry weight). The final fibre content in solid chocolate is dependent on the amount of non-fat cocoa solids in the product: dark chocolate tends to have the highest amount (7 g/100 g) whereas white chocolate (0.2 g/100 g) has very little fibre content.

22.2.3 Proteins

Cocoa is not a significant source of protein and the protein present is poorly digestible. Milk chocolate contains the greatest amount of, and most digestible, protein of any type of chocolate due to the addition of milk proteins.